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DISSERTATION

**MODELING SECOND LANGUAGE CHANGE USING
SKILL RETENTION THEORY**

by

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June 2013

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**MODELING SECOND LANGUAGE CHANGE USING SKILL RETENTION
THEORY**

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ABSTRACT

Loss of foreign language proficiency is a major concern for the Department of Defense (DoD). Despite significant expenditures to develop and sustain foreign language skills in the armed forces, the DoD has not been able to create a sufficient pool of qualified linguists. Many theories and hypotheses about the learning of foreign languages are not based on cognitive processes and lack the ability to explain how and why foreign language proficiency changes. This work analyzed 13 years of Defense Language Institute (DLI data) from over 16,000 military linguists to determine if cognitive-based skill retention theory can adequately explain foreign language change. Relationships between independent variables suggested by skill retention theory and second language change were investigated. Language proficiency and the length of time since DLI graduation demonstrated strong correlations with foreign language change. This research also affirms that decayed foreign language proficiency may be rapidly reacquired upon sufficient re-exposure to the target language. Additionally, this research proposes foreign language proficiency levels that must be attained to reduce language decay. The research findings are important since they may be used to determine a linguist's language decay over time and will help schedule appropriate refresher training to reduce decay or maintain current foreign language proficiency.

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LIST OF ACRONYMS AND ABBREVIATIONS

ACTFL	American Council for the Teaching of Foreign Languages
BC	Basic Course
DA	Diagnostic Assessment
DLAB	Defense Language Aptitude Battery
DLI	Defense Language Institute
DLI/CE	Defense Language Institute Continuing Education Directorate
DLPT	Defense Language Proficiency Test
DMDC	Defense Manpower Data Center
DoD	Department of Defense
DTRA	Defense Threat Reduction Agency
E&L	Ehrman and Leaver
FSI	Foreign Services Institute
GPA	Grade Point Average
ILR	Interagency Language Roundtable
L2	Second Language
MBTI	Myers-Briggs Type Indicator
MSLQ	Motivated Strategies for Learning Questionnaire
OPI	Oral Proficiency Interview
SLA	Second Language Acquisition
ZPD	Zone of Proximal Development

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I. INTRODUCTION

Language loss affects all of us. It occurs in every corner of the world, taking its toll among young and old alike.

—Hansen & Reetz-Kurashige, 1999

A. OBJECTIVE

This research seeks to develop a general comprehensive theory of foreign or second language (L2) acquisition, retention, attrition, and reacquisition using skill retention theory. If such an L2 theory can be established, it may suggest attrition rates of new linguists, shape L2 sustainment policy, and contribute to the instructional design of L2 courses.

B. FRAMING THE PROBLEM

The U.S. government expends more than a billion dollars annually in recruiting, training, and maintaining L2 linguists to ensure there are sufficient numbers available when needed (Lowe Jr., 1982; Vickers, 2011). Linguists are not always given the time to use or maintain their L2 skills, and without regular use these skills atrophy (Vickers, 2011). A conference held at the University of Pennsylvania in 1980 focused research efforts on L2 attrition, a well-known but little researched phenomenon (Weltens & Cohen, 1989; Weltens, 1987). Research findings were not presented; rather, those interested in this field were brought together to discuss possible avenues of research (Vechter, Lapkin, & Argue, 1990). Significant L2 attrition research has been conducted since this conference, but instead of developing an acceptable general theory of attrition, many researchers have focused on very specific phenomena (Ross et al., 2012), such as regression in German case marking (Jordens, De Bot, Van Os, & Schumans, 1986) or attrition of Japanese negation (Hansen, 1999). Many researchers treated acquisition, retention, attrition, and reacquisition as separate processes without considering how one impacts the others (Arthur Jr. et al., 2007). The majority of second language theories, including those addressing language decay, lack any cognitive architecture or processes to support or explain this phenomenon (Ortega, 2007; Schumann, 1990).

There is not a widely accepted general cognitive theory used to explain the relationships between language skill variables and L2 change (Hedgcock, 1991; Schumann, 1990). Change includes L2 acquisition, retention, decay, and reacquisition (Clark, 1982). Theory is “a set of statements about natural phenomena that explains why these phenomena occur the way they do,” and should be able to “make predictions about what would occur under specific conditions,” and “connect phenomena that on the surface appeared unrelated” (VanPatten & Williams, 2007a, p. 2). Thus, an important reason for studying L2 decay, while considering the entire acquisition process, is to determine how these skills are retained, lost, and reacquired (De Bot & Weltens, 1995). A general theory may reveal relationships with L2 change and other independent variables. Finding such a theory is of paramount importance since it may suggest how long it will take for a newly trained adult linguist to begin showing signs of L2 decay, or reveal the L2 decay rate based upon the original proficiency level achieved by the linguist (Ross et al., 2012). This theory could also be used to inform L2 sustainment policy and instructional design of L2 courses.

C. SIGNIFICANCE AND POTENTIAL IMPACT

L2 decay is a major concern to the U.S. government (Klein & Rice, 2012; Ross et al., 2012; Vickers, 2011) since it reduces the number of linguists available to the government to promote U.S. national security and fill positions requiring L2 skills (Vickers, 2011). The Department of Defense (DoD) recognizes warfighting competencies needed for the 21st century require L2 skills beyond its current capabilities (Department of Defense, 2005). With the trend toward non-kinetic warfare and peacekeeping missions, cultural knowledge and L2 skills have become warfighting competencies (Panetta, 2011), and must be treated like critical weapon systems (Graham, 2005). In response to this increased demand and to produce linguists with higher proficiency, the Defense Language Institute (DLI) will increase its basic course (BC) proficiency requirements for graduation from 2/2/1+ to 2+/2+/2 in 2015 (scores will always be reported in this format and represent listening/reading/speaking) (Association of the United States Army, 2010).

Despite the significant expenditure of resources to promote SLA, the DoD has not been able to develop a sufficient pool of linguists to meet the demand (Vickers, 2011). The DoD has done a poor job of identifying, tracking, and tapping military members with these critical L2 skills (Department of Defense, 2005), as well as understanding the importance of language and cultural skills (Gates, 2008). Complex cognitive skills, e.g., foreign language, are difficult to acquire; thousands of linguists are trained every year at DLI, but only about seventy percent attain the scores required for graduation (Wong, 2004). If the L2 skills of qualified DLI graduates are not maintained, those skills may decay to a point of being dysfunctional, meaning they can no longer be used (Andersen, 1982). As a result, the DoD will continue to have a deficit of skilled linguists to build, maintain, or enhance coalition and multi-national operations, peacekeeping, and civil/military affairs when needed (Department of Defense, 2005).

D. DEFINITIONS

The following phrases with their accompanying definitions are used throughout this dissertation:

- **Qualified DLI graduate** is any linguist who has successfully completed a basic course at DLI and attained the minimum proficiency scores required to graduate.
- **Unqualified DLI graduate** is any linguist who has successfully completed a basic course at DLI but did not attain one or more of the minimum proficiency scores required to graduate.
- **L2 change** is the “change in the scope or level of language performance over time, regardless of the direction of these changes” (Clark, 1982, p. 138).
- Reading and listening are **receptive skills**. A linguist receives information and must decode it into something meaningful.
- Speaking and writing are **productive skill** and require that a linguist actively produce information to be conveyed.

E. RESEARCH HYPOTHESES AND CONTRIBUTIONS

The following hypotheses were explored during the course of the research:

- H₁. Second language skills are an instance of sensory-motor or cognitive skills and therefore a variant of the three-level skill acquisition theory can be used to explain relationships between language skill variables and L2 change.**

In the past, some SLA theories have assumed that L2 skills, given sufficient input, would develop on their own through the activation of a language acquisition device (Spolsky, 1985), “which is seen to operate quite autonomously, that is, independently from and without any interaction with other cognitive abilities or faculties...” (Pütz & Sicola, 2010a, p. 1). This autonomous assumption began to change over the past two decades as SLA researchers looked to other domains to borrow methods and findings to better explain L2 change phenomena (Pütz & Sicola, 2010b). One such theory that shows promise is found in the cognitive psychology domain, specifically, a variant of the skill acquisition theory known as “skill retention theory” (Kim, Ritter, & Koubek, 2011). This theory posits that learning takes place in three stages: 1) knowledge acquisition, 2) knowledge consolidation, and 3) knowledge tuning (discussed further in Chapter II.C). Many skills from various domains show similar development from initial learning to highly skilled and fluent behavior, and “that this set of phenomena can be accounted for by a set of basic principles common to the acquisition of all skills” (DeKeyser, 2007a, p. 97). Demonstrating that L2 skills can be represented by the skill retention theory is an important contribution because current SLA theories in linguistics do not adequately address language change. This contribution may extend the generalizability of the skill retention theory to the language domain by helping to explain language change. Assuming H1 is found to be true, a second hypothesis can be explored:

H₂. Decayed L2 skills can be reacquired at an expedited rate as indicated by the skill retention theory.

Cohen (1989) demonstrated that L2 skills learned to a high proficiency are not really forgotten, but the ability to recall them deteriorates if not practiced consistently. Ebbinghaus found that forgetting is asymptotic and, even when a learner feels they have forgotten everything they learned in a given subject, there remains some residual activation for a given memory icon that may be used to relearn the subject at a faster rate (De Bot, Martens, & Stoessel, 2004; Ebbinghaus, 1913). De Bot et al. (2004) asserts that residual knowledge from earlier L2 learning can be used to reactivate forgotten L2 skills. This research will attempt to determine whether these atrophied skills can be reacquired at a faster rate than the original acquisition rate, for linguists who achieved a high level of proficiency. If the results confirm this, the DoD may be able to develop

“crash course” refresher training modules to help linguists quickly reacquire atrophied L2 skills (Department of Defense, 2005).

H₃. There is a specific L2 proficiency level that must be acquired to extend retention and reduce skill decay.

This research is designed to identify the proficiency level that must be achieved to promote long-term retention. It has been hypothesized that the higher proficiency a linguist achieves when learning an L2, the longer the proficiency may be retained (Cohen, 1975; Hansen, 1999; Hansen & Reetz-Kurashige, 1999; Hedgcock, 1991; Neisser, 1984). This level was found to be “advanced plus” for Japanese on the American Council for the Teaching of Foreign Languages’ (ACTFL) scale (Nagasawa, 1999), and should hold true for other languages (Table 1 compares the ACTFL and Interagency Language Roundtable (ILR) scales). Determining what proficiency level must be reached may be an important step in informing policy development, instructional design, and timing for L2 skill maintenance and sustainment training (Lowe Jr., 1982).

Table 1. ILR and ACTFL Scale Comparison (From SIL International, 1999)

ILR Scale	ACTFL Scale	Definition
5	Native	Able to speak like an educated native speaker
4+	Distinguished	Able to speak with a great deal of fluency, grammatical accuracy, precision of vocabulary and idiomaticity
4		
3+	Superior	Able to speak the language with sufficient structural accuracy and vocabulary to participate effectively in most formal and informal conversations
3		
2+	Advanced Plus	Able to satisfy most work requirements and show some ability to communicate on concrete topics
2	Advanced	Able to satisfy routine social demands and limited work requirements
1+	Intermediate High	Able to satisfy most survival needs and limited social demands
1	Intermediate Mid	Able to satisfy some survival needs and some limited social demands
	Intermediate Low	Able to satisfy basic survival needs and minimum courtesy requirements
0+	Novice High	Able to satisfy immediate needs with learned utterances
0	Novice Mid	Able to operate in only a very limited capacity Unable to function in the spoken language
	Novice Low	
0	0	No ability whatsoever in the language

H₄. The Diagnostic Assessment (DA) tool used by the Defense Language Institute, Continuing Education Directorate (DLI/CE) can identify L2 skills that are ready to transition from declarative to procedural knowledge.

The formative nature of the DA tool identifies what L2 skills students need to reach the next ILR level. It is hypothesized these skills are declarative, decay with time, and need to be strengthened in order to change procedural, thought to be immune to decay.

The DA also captures the learner's language aptitude, attitude, motivation, personality traits, and sensory preferences. This research will identify what kind of relationship exists among L2 aptitude tests such as the Defense Language Aptitude Battery (DLAB), basic course grade point average (GPA), Defense Language Proficiency Test (DLPT) scores, Oral Proficiency Interview (OPI) ratings, and L2 change.

F. DISSERTATION OUTLINE

This dissertation is organized into the following chapters:

Chapter II, Background and Related Work: The purpose of this chapter is to present the necessary background information to understand the research question and how it will advance the understanding of SLA, retention, and attrition. This chapter presents the following topics: learning theories of behaviorism and cognitivism, Vygotsky's Zone of Proximal Development, major SLA theories, L2 attrition studies and hypotheses, skill acquisition theory, and skill retention theory. In addition, the discussion on Vygotsky's Zone of Proximal Development will be further developed to include the Cognitive Apprenticeship model and DLI's Diagnostic Assessment tool.

Chapter III, Methodology: This chapter presents the research methodology and why it was chosen over other approaches. Additionally, there is a section on data collection and encoding.

Chapter IV, Findings and Discussion: This chapter discusses the statistical analyses performed, why they were chosen, and the results achieved.

Chapter V, Conclusion and Future Work: The major findings of the research are presented as well as future work to further the understanding of SLA and retention.

II. BACKGROUND AND RELATED WORK

A. RISE OF L2 ATTRITION RESEARCH

Van Els (1986) classified language decay research into four types as depicted in Figure 1. This research will focus on type 3, the loss of L2 skills in an L1 environment. Many L2 attrition studies have adopted L1 attrition hypotheses and used them as “interpretations of findings rather than as hypotheses that frame investigations,” while also taking into account additional variables and contributions from other fields (Bardovi-Harlig & Stringer, 2010, p. 15). While many of these studies provide valuable insight into what L2 aspects are vulnerable to attrition, general L2 skill decay is not given nor are factors that increase or decrease the amount of L2 loss presented (Ross et al., 2012). This section will provide a condensed L2 attrition history with the main focus on category 3 research.

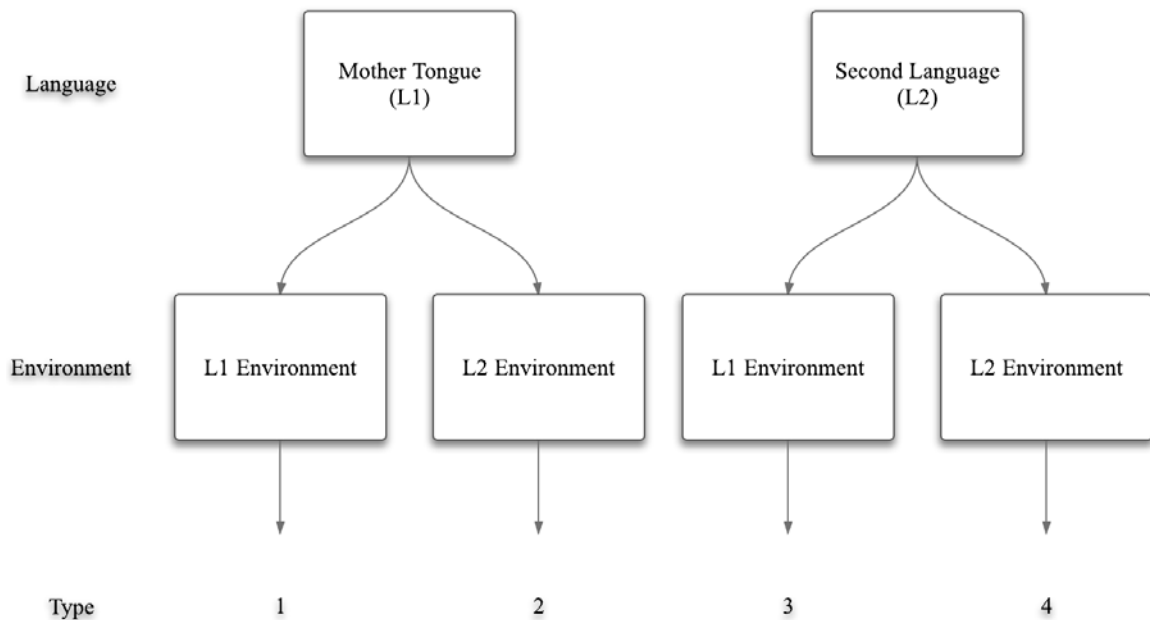


Figure 1. Types of Attrition Research (From Van Els, 1986)

Prior to 1975, very little research was conducted on language attrition (Cohen, 1975). This changed following the attrition conference held at the University of

Pennsylvania, which focused research efforts into understanding language retention and loss (Freed & Lambert, 1982). Goals of attrition research are to help understand how to reacquire or relearn decayed L2 skills (De Bot & Weltens, 1995), identify factors that may enhance post-training skill retention (Arthur Jr. et al., 2007), and develop better methods of instruction to delay, slow down, or prevent L2 loss (Hedgcock, 1991).

1. Baseline

In order to conduct L2 change research, a baseline measurement is necessary to establish the amount of knowledge or skill that has been lost (Bardovi-Harlig & Stringer, 2010). Anderson proposed that a baseline could be gathered from people competent in an L2 and then use that baseline to compare linguists who were once competent in the same L2 to determine how much they have lost (Andersen, 1982). A problem with this proposition is that learners with similar backgrounds acquire and forget knowledge at different rates, so what may be a well-established baseline for one individual will not work for another (Cohen, 1975). In addition, baselines established by such means are insufficient to measure attrition; rather, “learners must be compared to themselves” (Bardovi-Harlig & Stringer, 2010, p. 24). The most effective way to establish an individual baseline for a learner is to use the learner’s documented peak attainment in each modality that will be tested for attrition and then compare later L2 skills against the baseline (Bardovi-Harlig & Stringer, 2010).

2. L2 Loss or Failure to Acquire

Another challenge pointed out in L2 change research was differentiating between true L2 loss and failure to acquire the L2 skills (Andersen, 1982; van Els, 1986). If an L2 learner never acquired a specific aspect or skill of an L2 and was tested for it, the results would show the learner underwent more attrition than really took place. Learners should be compared against their previously established baseline so that previously learned skills and proficiencies that may have decayed may be revealed (Reetz-Kurashige, 1999). Identifying these lost skills and proficiencies requires personalized tests that are reliable and accurate.

3. The Regression Hypothesis

The regression hypothesis has been perhaps the most researched and discussed attrition hypothesis (Bardovi-Harlig & Stringer, 2010). This hypothesis states L2 skills are lost in the reverse order from how they were acquired or learned. This hypothesis has its origins back in the 1880s. Ribot's law, proposed by French psychologist Théodule Ribot, posits that knowledge is lost in a regression, e.g., the most recently learned items are the first to be forgotten (Berko-Gleason, 1982; Pan & Gleason, 1986). This rule was later put into linguistic terms by Jakobsen in 1941, and has become known as the regression hypothesis (Hedgcock, 1991; Keijzer, 2004). The regression hypothesis can be viewed through several different lenses: acquisition sequence, interlinguistic, and intralinguistic. Each of these lenses will be briefly discussed.

Depending on how one defines the acquisition sequence, this hypothesis can be interpreted in one of two ways: 1) chronological regression—knowledge or skills that are first in are the last to be forgotten or 2) processing model of regression—knowledge or skills that are learned best, regardless of acquisition order, are the last to be forgotten (Hedgcock, 1991).

a. Chronological Regression

Some have described chronological regression as being a “mirror image” of the acquisition process (Hansen & Reetz-Kurashige, 1999; Vechter et al., 1990; Weltens & Cohen, 1989; Weltens, 1987). Olshtain pointed out that chronological regression may exist, but is limited in nature, and may be more pronounced in those linguists who have not achieved a high level of proficiency (Olshtain, 1989). Reetz-Kurashige argued that this form of regression “has proved difficult to assess” (Reetz-Kurashige, 1999, p. 24). One reason is people do not always learn new knowledge or skills in the same order as the knowledge or skills were presented. Put another way, the order of input does not equal the order of acquisition (Hedgcock, 1991). After a review of attritional studies, Bardovi-Harlig and Stringer concluded that there was “very little evidence,” and a “general lack of empirical support,” for the chronological regression hypothesis (Bardovi-Harlig & Stringer, 2010, p. 3)

b. Processing Model of Regression

Andersen first described the processing model of regression by proposing that the best learned L2 skills will be the last to be forgotten (Andersen, 1982). This interpretation of the regression hypothesis is a cognitively driven model and follows the Pitres Rule, which was presented in 1895 and states that knowledge and skills that are learned the best should last the longest and are the most resistant to decay (Berko-Gleason, 1982; Hedgcock, 1991). Hedgcock described these enduring types of knowledge and skills as having “undergone some form of deep processing,” and are permanent in the learner’s language faculty (Hedgcock, 1991, p. 44). This description fits well with the language used to describe procedural knowledge in the three-stage skill retention theory. Hedgcock conducted an experiment where he assessed the order of skills presented in a L2 classroom to the actual order of acquisition of individual students. Following this process, he evaluated the attrition of these newly acquired skills to see if they followed the chronological or processing model of regression. He concluded that the processing model appears promising for “explaining and predicting” L2 attrition (Hedgcock, 1991, p. 52).

c. Interlinguistic and Intralinguistic Regression

At the interlinguistic level, the level at which all languages share commonalities, the chronological regression hypothesis appears to hold. Receptive skills (listening and reading) are acquired before productive skills (speaking and writing) and attrition of these skills takes place in reverse order (Hansen & Reetz-Kurashige, 1999). Hansen stated, however, that at the intralinguistic level, e.g., “within morphology, syntax, the lexicon,” trying to establish if decay is in fact the reverse of acquisition is more difficult to determine (Hansen & Reetz-Kurashige, 1999, p. 9). Intralinguistic research is limited in generalizability because it has only focused on a limited number of specific syntactic structures (Yoshitomi, 1992), which will be further discussed in Section A.7 of the Chapter.

4. Threshold hypothesis

The threshold hypothesis is an evolution of the processing model of regression. Instead of basing attrition on what is learned best, this hypothesis states if a certain threshold is reached, L2 skills will be less likely to be forgotten. The threshold hypothesis' genesis began with Bahrick's seminal research on language attrition. He conducted a cross-sectional study on the retention of L2 skills of learners of Spanish during a 50-year period. He claimed language skills that were well-learned during the acquisition phase entered into memory he called "permastore" where it became immune to attrition (Bahrick, 1984). Neisser took issue with the term permastore and argued that when L2 proficiency reaches a critical threshold, those L2 skills become less vulnerable to attrition (Neisser, 1984; Yoshitomi, 1992). Variants of the critical threshold hypothesis have arisen and are known as the threshold hypothesis (Bardovi-Harlig & Stringer, 2010), critical mass (Pan & Gleason, 1986), and the activation threshold hypothesis (Paradis, 2007). Each of these hypotheses indicates there may be a level in language proficiency that once achieved may reduce or eliminate L2 change, but no empirical data are given to support a specific level. Only two studies have attempted to identify what this level may be. One study used the opinion of Foreign Service instructors and testers that the threshold was level 3 on the Foreign Service Institute's scale, which is the same as the ILR scale (Clark & Jorden, 1984). The other proposed this level to be "advanced plus" or 2+ based on Japanese L2 linguists (Nagasawa, 1999).

5. Inverse Hypothesis

A variant of the threshold hypothesis is the inverse hypothesis (Reetz-Kurashige, 1999). While this hypothesis does not specify what level needs to be achieved, it posits that higher L2 proficiency will increase L2 retention (De Bot & Weltens, 1995; Gardner & Lysynchuk, 1990; Kennedy, 1932; Nagasawa, 1999; Vechter et al., 1990 in interpreting finding in Edwards, 1977). This hypothesis has also been called the inverse relationship (Bahrick, 1984; Nagasawa, 1999; Neisser, 1984; Weltens, 1987).

6. Savings Approach/Effect

Ebbinghaus' groundbreaking research on memory led to the savings effect (Ebbinghaus, 1964), which has been defined as the advantage of relearning old items over new items, (Nelson, 1978). Figure 2 depicts the savings effect of relearning on old item compared to learning a new item. During his research, Ebbinghaus would memorize a list of nonsensical words until he could recall the list perfectly. Once he had perfect recall, he would stop studying or reviewing the list until he had forgotten it, at which point he would begin the process of memorizing the list again. He noted that the time required to memorize the list the second time was less than the first time. This reduced time in relearning knowledge is known as the savings effect or approach.

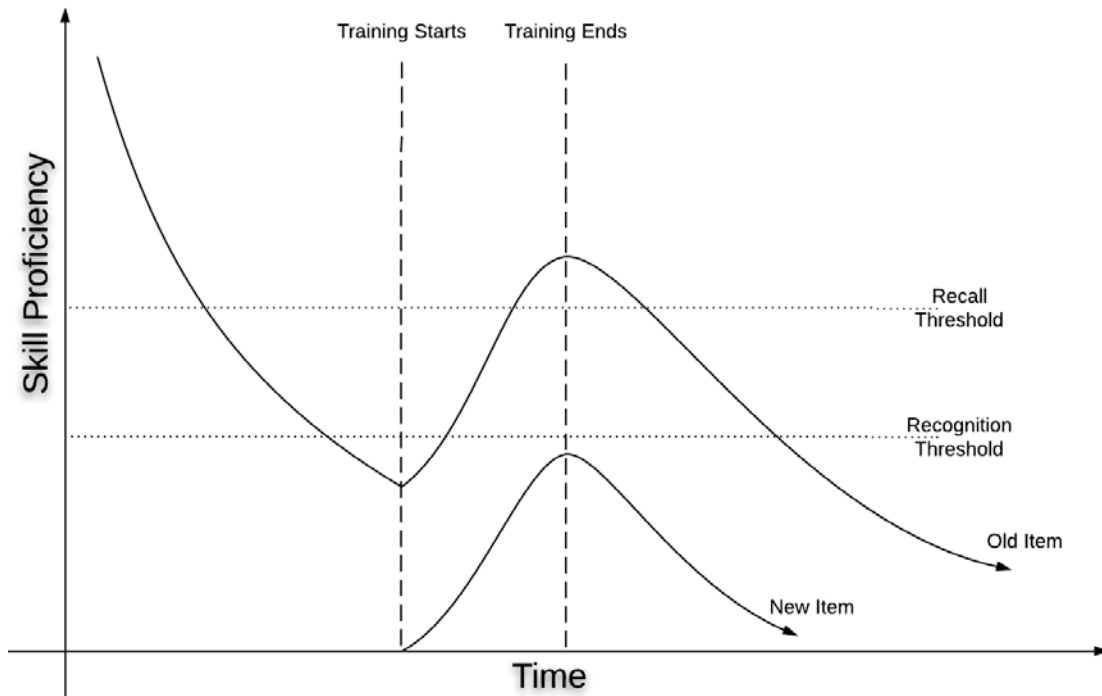


Figure 2. Savings Effect of Learning an Old Item Compared to a New Item (After De Bot & Stoessel, 2000)

One of the earlier stated purposes for L2 change research is to better understand the relearning of L2 proficiency once it has decayed. Psychological researchers generally agree that knowledge is not lost once it has been acquired (De Bot & Weltens, 1995; Hansen, 2001) because knowledge decay is asymptotic; “so that even after a long time,

there will be at least some residual activation left for a given item” (De Bot & Stoessel, 2000, p. 336). De Bot & Stoessel (2000) further stated that for knowledge to be recalled (i.e., actively produced), its activation must be fairly high, whereas a lower activation will suffice for recognition (i.e., recognized but not actively produced). If the activation drops too low, the item can no longer be retrieved. The savings effect posits that forgotten skills or knowledge might be reacquired faster than new knowledge or skills.

a. Anecdotal Support

“Din in the Head” or the “Boulogne Ferry Effect” refer to anecdotes that offer support for the skill retention theory and savings effect (Bardovi-Harlig & Stringer, 2011). Linguists who have learned an L2 to a high proficiency but have not used or practiced the language for some period of time have reported that upon re-exposure to the L2, whether through immersion or training, that the language has suddenly come back to them.

One such instance is recorded by Barber (1980). She related the following experience while traveling to Russia. On the third day of working with a curator at the Hermitage, she began to notice that there was a “rising din of Russian in my head: words, sounds, intonations, phrases, all swimming about in the voices of the people I talked with” (Barber, 1980, p. 30). She felt that her command of Russian improved more in a week than if she had spent a couple of months of intensive reading.

Another researcher experienced this same phenomenon shortly after disembarking a ferry in France. He said that just by “walking down the main street in Boulogne shortly after getting off the ferry, can sometimes trigger the reactivation of a whole stream of dormant French vocabulary” (Meara, 2005, p. 271). He conducted a limited study of the savings effect on one participant and found that after a week of in-country immersion, the active vocabulary of the participant had nearly tripled. Meara cautioned about the results of his research since it only used one participant, yet it adds another example of what may happen to linguists who return to language training or immersion after an extended period of non-use.

Bardovi-Harlig & Stringer (2011) summarized the anecdotal support for the return of L2 skills and proficiency. They stated, “it is a plausible hypothesis that the recall of common constructions, conversational idioms and conventional expressions in daily use all help to stimulate this recovery, as multi-word expressions are laden with syntactic information” (Bardovi-Harlig & Stringer, 2011, p. 17).

b. Research Support

While one of the stated purposes of L2 change research is for L2 relearning, there has not been much research into reacquiring a forgotten L2 (Hansen, 2001). Most of the research in this domain has been done with adults who learned an L2 as children, but have since forgotten it. This section, however, will present research that did not use child L2 learners to evaluate the savings effect.

One of the first research observations of the savings effect was noted in 1932 (Kennedy, 1932). Students in Latin were administered a standardized Latin syntax test before summer break. Of the 137 students who continued with Latin after the summer break, none studied Latin during the summer. The students were administered the same test upon returning to school after summer break and again one month after resuming their studies. Kennedy observed that one month of studies in Latin “was more than equal to the task of returning this group to its initial level of achievement” (Kennedy, 1932, p. 141).

Hansen, Umeda, and McKinney (2002) tested 304 native speakers of English who had served religious missions in Korea and Japan for the savings effect in vocabulary. One hundred and sixty words were taken from the lessons the missionaries had memorized; these were used with 16 made up words in testing the savings effect. During the interview stage of the experiment, the 160 previously known words were presented. The participant was to indicate if the word was known or unknown; once 16 unknown old words were identified, the teaching phase began.

The teaching phase consisted of teaching the 16 forgotten old words along with the 16 made up words, and then a learning comparison was drawn between the two sets of words. A stronger savings effect was observed with the old words than with the

made up words. The results were summarized by stating that those who have forgotten lexical knowledge “retain a substantial advantage in regaining that knowledge, in comparison with others who are learning the same words for the first time” (Hansen et al., 2002, p. 669). It was also observed that missionaries with a larger lexicon experienced a greater savings effect than those with a smaller lexicon in relearning old words as well as learning new words.

A similar experiment was done with American university students who were currently learning German and Dutch university students who had previously learned French while in high school (De Bot et al., 2004). A list of old words that had been forgotten by these students, evaluated in the same manner as in the prior study, was compiled along with a list of new words not known by the students. A list of old and new vocabulary words was given to the student to learn. The results of the experiment showed that the old words were learned much faster than the new words by both groups of students. The research was summarized by stating the “data support the underlying assumptions supporting the savings paradigm, and in particular the idea of asymptotic decay of lexical knowledge” (De Bot et al., 2004, p. 382). One conclusion drawn by the researchers was that anyone who had learned an L2 earlier, but has forgotten it, still has residual knowledge of that L2, and this residual knowledge can be used to reactivate the lost L2 skills and proficiency.

7. Researching Specific Phenomena

Ross et al. (2012) pointed out that there has been active research on language change since the conference at the University of Pennsylvania in 1980, but much of this research has focused on what parts of L2 are lost and the order in which L2 decays. The prior section on the savings effect illustrates this; the research focused on testing if the savings effect could be found in language syntax and vocabulary.

Language change research on specific phenomena has produced hypotheses that model narrow aspects of L2, but researchers have not been able to consistently verify them (Cohen, 1975; Hedgcock, 1991; Oxford, 1982a; Reetz-Kurashige, 1999; Vechter et al., 1990). One researcher concluded that there is no single rule that can be applied to all

SLA learners in language attrition (Oxford, 1982b). Another researcher stated that linguistic researchers were trying to build their own models of learning and forgetting, without referencing learning theory found within the field of psychology, and were producing models with little explanatory power (Spolsky, 1985).

Starting in the mid-1980s, some researchers began drawing upon cognitive psychology to help develop theories of SLA, but very little progress has been made in developing a general language change theory that addresses how quickly L2 skills decay following training completion. This slow theory development is because the methodology required to conduct such research requires a large number of subjects to be tested over a long period of time and would produce lots of data for statistical analysis (DeKeyser, 2007a). If a general theory can be developed, it may connect the previously mentioned hypotheses that currently appear unrelated (VanPatten & Williams, 2007a).

8. Incubation Period

Aside from Bahrick's 50-year study, the vast majority of the studies have very small incubation times. An incubation period is defined as the time between formal language study termination and the time when the L2 skills are reassessed, during which the linguist is not engaged in linguistic training and does not have "opportunities or pressures to use the language," and proficiency changes for various reasons (Gardner & Lysynchuk, 1990; Gardner, 1982, p. 25). According to Ross et al. (2012), the amount of proficiency lost should increase with increased time away from training, all other factors being equal; the length of time since formal language training ended is an intuitive way to explain the amount of language loss.

The incubation period for many attrition studies covered a summer vacation, roughly three months, but rarely extended beyond a year. Such short incubation periods make it difficult to find any patterns of language change because knowledge associations and networks enhance retention (Ross, Steven J. Bloomfield et al., 2011). One common method for researching language change is to record linguists' proficiency at the conclusion of a course and then test their proficiency after some incubation period (Edwards, 1977; Gardner, Lalonde, Moorcroft, & Evers, 1987). While these types of

studies have contributed to a greater understanding of L2 change, little is known about what happens to the linguist's skills during the incubation period. A study that repeatedly measured linguists' skills during the incubation period would help to better understand what L2 changes are taking place during the incubation period (Ross et al., 2012).

This dissertation research will use incubation periods that are much longer, averaging six years, which should be enough time to see if any patterns in L2 change develop similar to those proposed by the skill retention theory. The linguists' graduation scores, or baseline, will be used to determine how much proficiency was lost during the incubation period, as well as track what happens to their proficiency during the incubation period by analyzing their annual proficiency tests.

B. COMPLEX SKILLS

Skill is defined as “goal directed, well-organized behavior that is acquired through practice and performed with economy of effort” (Proctor & Dutta, 1995, p. 18), and can be motor or cognitive (Carlson, 2003; Stothard & Nicholson, 2002). The ability to learn a foreign language is a cognitively complex skill, which can take years to reach an acceptable level of proficiency, and can perish quickly. It is difficult to model or develop theory for these complex skills because they involve many interrelated processes that use various types of knowledge to carry out and solve problems within a specific domain (Van Merriënboer, 1997). Current SLA theories predominately come from one of two fields of study: linguistics or cognitive psychology (VanPatten & Williams, 2007a).

1. Linguistics

Many linguistic researchers treat SLA separately from other skill development because they assume language processes operate on different principles from those of other learned skills (R. Ellis, 2008; O'Malley & Chamot, 1990; VanPatten & Benati, 2010). As a result, SLA models were developed independent of accepted learning theories but none have been universally accepted (O'Malley & Chamot, 1990; Spolsky, 1985). This research will not use theories from the linguistics field because this field does not have the theories needed to explain L2 change.

2. Psychology

Three prominent learning theories within psychology are behaviorism, constructivism, and cognitivism. These theories will be described in brief, including how they may relate to language learning.

Behaviorism is based on stimulus and response and does not consider what processes are occurring within the learner to bring about a response; the brain is considered a “black box.” “There is, in fact, no real evidence for the behaviorist explanation of SLA” (VanPatten & Williams, 2007b, p. 21). This theory will not be considered for this research except to demonstrate that repeated practice reduces response times, e.g., the power law of learning discussed later (DeKeyser, 2007a).

Constructivism posits that learners use prior experiences, previously acquired knowledge, and beliefs to construct new knowledge (Jonassen, 1991). It is assumed that learners who construct their own solutions have the best learning experiences (Kirschner, Sweller, & Clark, 2006). Constructivism generally cannot be applied to basic language courses at DLI since students normally do not have prior experiences and knowledge of the language by which to construct new knowledge (Stothard & Nicholson, 2002), nor are there any prominent SLA theories based on this learning theory (VanPatten & Williams, 2007a). For DLI students returning for follow-on language courses, however, constructivism does play a role and will be discussed later in the section on Vygotsky’s Zone of Proximal Development (ZPD).

The term “cognitive” has been defined as “mental processing of information” (Sakul-Thanasakdi, 2001, p. 1), and cognitivism is an effort to open the black box of the mind to reveal how knowledge is learned. The most common cognitive architecture to describe the learning process is composed of working memory, long-term memory, and sensory inputs (Atkinson & Shiffrin, 1968).

Working memory is also known as short-term memory, and is where all conscious processing takes place. It can only hold a limited number of elements at a time and if these elements are not rehearsed to keep them active in working memory they will be lost within 30 seconds (Juffs & Harrington, 2011; Kirschner et al., 2006; Sakul-Thanasakdi,

2001). Working memory processes information that is received from the outside world through sensory inputs, organizes the information, and combines it with knowledge that is held in long-term memory through encoding; if the new information is similar to knowledge already contained in long-term memory, then it will be stored and remembered more easily (Sakul-Thanasakdi, 2001).

Long-term memory is the central, dominant, highly organized structure of human cognition where potentially limitless amounts of knowledge and experiences are stored for later recall (Kirschner et al., 2006; Sakul-Thanasakdi, 2001; Sweller, van Merriënboer, & Pass, 1998). Long-term memory allows experts in a specific domain to recognize more patterns and structures from that domain than an apprentice or novice, and as a result they are able to act and react more quickly and with more proficiency (Dreyfus & Dreyfus, 1980; Sakul-Thanasakdi, 2001). Long-term memory is thought to be the main factor that influences learning and retention of new information; prior knowledge plays a major role in learning new information by creating networks and associations between the prior and new knowledge (Sakul-Thanasakdi, 2001).

Learners' sensory inputs gather new information from the world around them for processing. This information is held in buffers for a limited period of time so the working memory can decide whether it is useful or not; if it is, working memory will process this new information for storage in long-term memory, otherwise newer information coming into the sensory inputs will overwrite the old information (Sakul-Thanasakdi, 2001). The human body uses all five senses to acquire new information, but the two most prominent senses are auditory and visual. This research will not deal with sensory input as an independent variable.

Cognitive Load Theory posits that working memory's limited capacity can quickly be overloaded by poorly designed courses; this may prevent a learner from learning new knowledge as efficiently and effectively as possible (Sweller et al., 1998). Instructional design should consider the intrinsic cognitive load, or the difficulty of the material to be taught, as well as the extraneous cognitive load, or how the material is presented, to reduce the load on working memory (Sweller et al., 1998). A well-designed course will prevent overloading working memory, which is especially important in complex cognitive tasks like SLA.

C. THREE-STAGE SKILL ACQUISITION

Several proposed skill acquisition theories use three stages, or phases, of learning where each stage is represented by qualitative differences in performance (Proctor & Dutta, 1995). Proctor and Dutta (1995) reviewed three prominent three-stage skill acquisition theories of Fitts (1964), Anderson (1982), and Rasmussen (1986). Kim, Ritter, and Koubek (2011) summarized these theories and added another three-stage theory of VanLehn (1996). Fitts (1964) identified the three stages of learning as cognitive, associative, and procedural and it was his work that influenced the development of Anderson's and Rasmussen's theories. Anderson (1982) named the three stages declarative, transitional, and procedural, while Rasmussen (1986) specified the execution of skills at these different levels as knowledge-based, rule-based, and skill-based (Kim et al., 2011). VanLehn's theory called these stages early, intermediate, and late. These theories all provide a common three-stage framework of skill acquisition, shown in Figure 3, "that includes: (1) acquiring declarative and procedural knowledge, (2) consolidating the acquired knowledge and (3) tuning the knowledge towards overlearning" (Kim et al., 2011, p. 3).

Some researchers have been studying SLA from a cognitive perspective since the early 1980s (N. C. Ellis, 2007). The three-stage skill acquisition theory, which describes how learners acquire skills and progress from beginners to experts, is a useful framework by which to study L2 change (DeKeyser, 2007a). Anderson's skill acquisition theory proposes two types of knowledge, declarative and procedural, which reside in long-term memory (J. R. Anderson, 1982; Fitts, 1964; VanLehn, 1996). Declarative knowledge is defined as factual knowledge, or knowing about something and procedural knowledge is defined as task knowledge, or knowing how to do something (J. R. Anderson, 1982; Kim et al., 2011; VanPatten & Benati, 2010). While declarative knowledge decays over time, and may become inaccessible if not actively used, procedural knowledge is thought to be relatively immune to decay (J. R. Anderson, 1982; DeKeyser, 2007a; Kim et al., 2011).

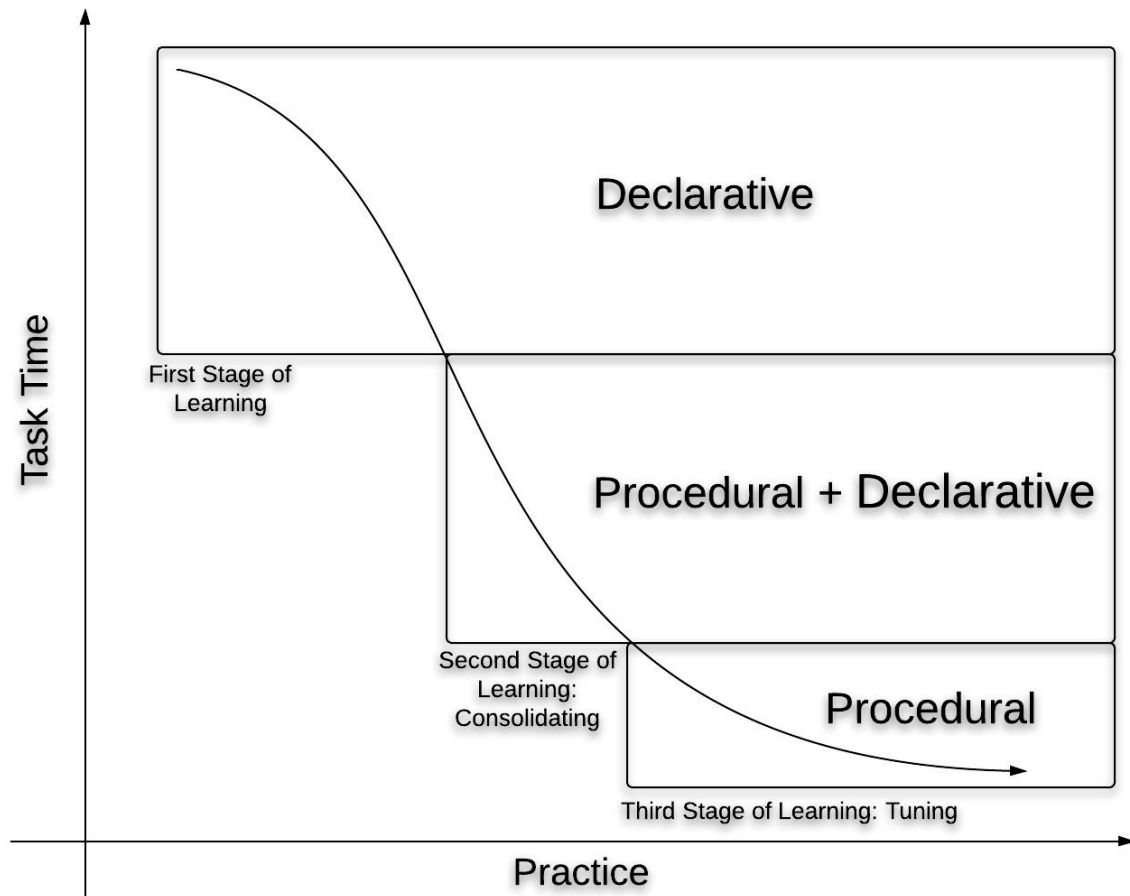


Figure 3. Three-Stage Learning Theory (From Kim et al. 2011)

In the skill acquisition theory's first stage, the majority of knowledge, rules, and skills acquired by learners are represented by declarative knowledge. Performance, or task completion, is slow, full of mistakes, and cognitively intense (DeKeyser, 2007a; Dreyfus, 2004; Kim et al., 2011). As learners repeatedly practice using this new knowledge, they enter the second stage of learning. This stage represents the consolidation of knowledge, which can be both declarative and procedural (Kim et al., 2011). Consolidation takes place by strengthening knowledge through practice and use, and moving it into long-term memory. As declarative knowledge strengthens, it begins to transform into procedural knowledge. Skills performed using procedural knowledge are faster, smoother, and not as error-prone. If the skill is still based on declarative knowledge, performance will be similar to that of stage one. After substantial training and use the learner enters the third stage in which the majority of the skills are procedural

(Kim et al., 2011). Performance is quick and efficient with little or no errors and learners are highly proficient at the task (Dreyfus, 2004). Fine-tuning of procedural knowledge takes place at this stage through large amounts of practice, or overlearning. With enough practice, the procedural skills can be automatized and the learner can eventually operate at or near the expert level (Dreyfus, 2004; Anderson, 1982; DeKeyser, 2007a, 2007c; Kim et al., 2011).

The skill retention theory proposed by Kim et al. (2011), a variant of the skill acquisition theory, also follows the three-stage learning process as described earlier, and includes forgetting at each stage, as depicted by the red dashed lines in Figure 4. In the first stage, if the learner does not practice the declarative skills or terminates instruction, the skills will rapidly decay. As declarative knowledge weakens, certain aspects of decay may become manifest, e.g., increased task completion time, increased errors, decreased retention, and eventually “catastrophic memory failure,” which is defined as declarative knowledge needed to complete a task cannot be retrieved from memory because of a lack of use or practice (Kim et al., 2011). If the learner practices these new skills, or resumes training (depicted by short black solid lines attached to the red dashed lines in Figure 4), the strength of the declarative knowledge increases and may eventually transition to procedural knowledge (J. R. Anderson, Bothell, & Byrne, 2004; DeKeyser, 2007a; Kim et al., 2011).

Continued training or instruction is critical in stage two to keep declarative knowledge active (strong) enough to proceduralize (J. R. Anderson, 1982; Kim et al., 2011). When training stops, catastrophic memory failure can still occur. For example, if procedural knowledge depends upon declarative knowledge to complete a task, or if a skill has not been completely proceduralized and the declarative knowledge it is transforming from decays to a point where it cannot be used, catastrophic failure may occur (Kim et al., 2011). The goal of training in this stage is to proceduralize as much declarative knowledge as possible. It is hypothesized that the majority of basic course qualified DLI graduates are in the second stage of learning immediately following graduation.

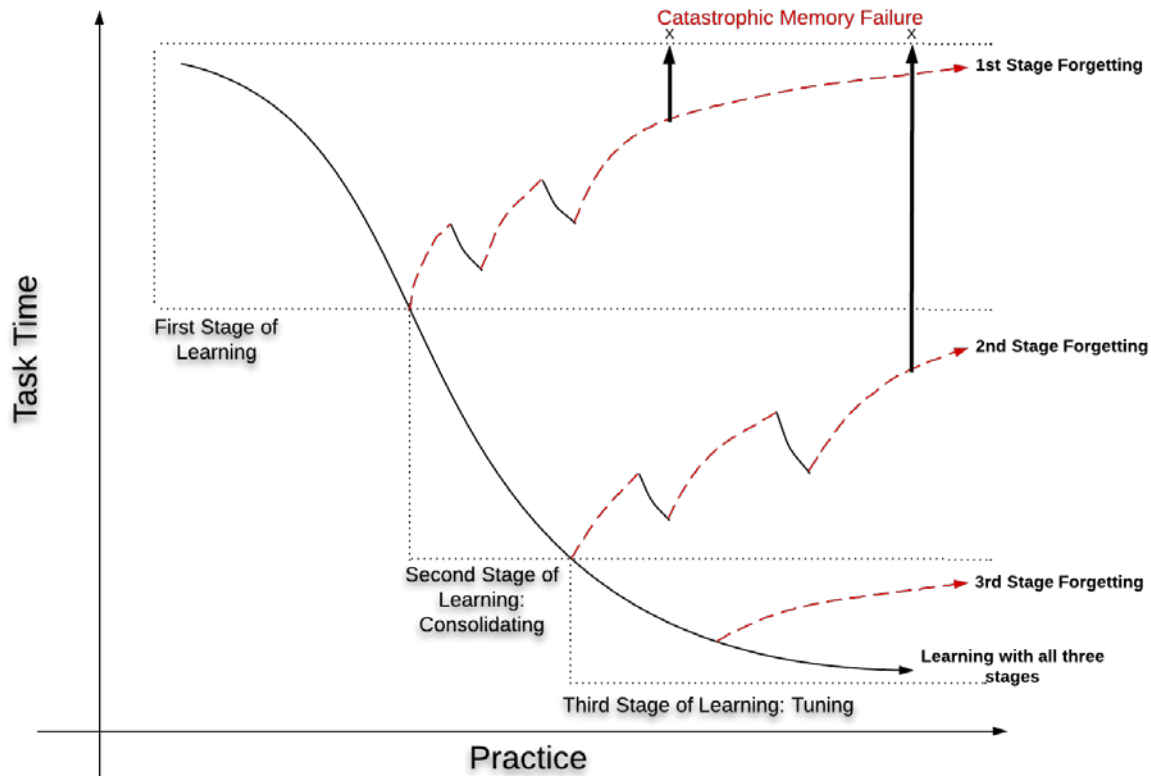


Figure 4. Three-Stage Learning Theory with Forgetting (From Kim et al. 2011)

In the third stage of the skill retention theory, performance may become less efficient with lack of skill use, but catastrophic failure does not occur since procedural memory is immune to decay. With re-exposure to the skill, performance should return to earlier proficiency levels. A simple example is used to illustrate the theory's three stages of learning and the distinction between declarative and procedural knowledge (J. R. Anderson, 1993 as related in Kim et al., 2011, p. 3).

Typing, a psychomotor skill, like many other skills, has the same structure of declarative knowledge being transformed into procedural knowledge. When students learn to type, they must first memorize the location of the keys on the keyboard. As this knowledge is declarative, and located in stage one of the skill acquisition theory, the learners' typing is slow, methodical, and contains frequent mistakes. The learners must look at the keyboard frequently to remember where certain keys are located. As the learners continue to practice, they are able to memorize the entire keyboard, type at a faster rate without thinking about where each key is located, and do this with fewer

mistakes. At this stage, declarative knowledge begins to transform into procedural and the learners enter stage two. In this stage, learners begin to rely more upon procedural knowledge than declarative and typing speed increases. When a less-frequently used key is needed, the learners' performance reverts back to declarative knowledge, e.g., "q is above a." The remaining declarative knowledge of the keyboard layout slowly proceduralizes with continued practice. In stage three, the learners rely almost exclusively on procedural knowledge. Instead of using declarative knowledge to remember the position of the "a" key, learners often imagine "typing a letter and seeing where their finger goes." While typing speed may decrease as a result of less practice, the skill will not be entirely lost as in stages one and two. Original proficiency levels may return by resuming practice.

Knowledge and skills do not move through the three stages together. Some skills and subskills are quickly learned and progress rapidly to stage three while other skills and subskills take longer (Kim et al., 2011). Some skills cannot be learned until more basic skills have been mastered. For instance, an L2 learner may be able to speak in the present tense, but not know how to speak in either the past or future tense. While being proficient at a specific language level, i.e., listening level 3, the skills required for that level may not all be in the same stage of learning. If this is the case, then when a linguist stops training or practice, those skills in the first two stages of learning may quickly decay and the linguist may drop to the previous proficiency level.

One of skill acquisition theory's key concepts is the power law of practice (DeKeyser, 2007a). Cognitive skills, such as SLA, follow this law (VanLehn, 1996), which states that the time to complete a task decreases with more practice, with the greatest improvements at the beginning and then approaching an asymptote later (J. R. Anderson, 2005; N. C. Ellis, 2006; Kim et al., 2011; MacKinnon, 2007; Pirolli & Anderson, 1985). It has been shown that cognitive skills improve at a faster rate than motor skills (Dar-El, Ayas, & Gilad, 1995).

The power law of forgetting posits that the loss of a skill is rapid when practice first stops, with measurable results within two and half minutes (Dar-El et al., 1995), but slows over time as it approaches an asymptote (Anderson, 2005; Ebbinghaus, 1913;

Finkenbinder, 1913; Wickelgren, 1974; Wixted & Ebbesen, 1991; Kim et al., 2011). Others have proposed that the rate of forgetting may be dependent upon the original skill level achieved (Bahrick, 1984; de Bot & Weltens, 1995; Neisser, 1984; Yoshitomi, 1992). Following termination of language instruction, beginning learners may quickly lose their skills to the point of a catastrophic memory failure (Kim et al., 2011), or dysfunctional attrition (J. R. Anderson, 1982). The rate of attrition may slow as higher levels of proficiency are acquired because associations and networks between skills and knowledge make stronger memories (Cohen, 1975, 1986; Dar-El et al., 1995; de Bot & Stoessel, 2000; Finkenbinder, 1913; Hedgcock, 1991; Kennedy, 1932; Meara, 2004; Neisser, 1984). As Neisser concluded, “Information that is tied into an extensive and redundant cognitive structure ... is sharply resistant to forgetting; isolated pieces of information, in contrast, are much more vulnerable” (Neisser, 1984, p. 34). While some skills may decay, high-proficiency linguists are still able to communicate but may not be as efficient as they once were; this type of attrition has been described as cosmetic (Andersen, 1982).

D. ZONE OF PROXIMAL DEVELOPMENT

DLI's Continuing Education Directorate (DLI/CE) uses Russian psychologist Lev Vygotsky's Zone of Proximal Development (ZPD) as the foundation for the diagnostic assessment (DA), which will be discussed later. The ZPD has had a significant impact on the development of constructivism learning theory (Applefield, Huber, & Moallem, 2000). Students returning for additional language courses following graduation from the basic course are administered the DA. The results from the DA are used to develop individual intervention learning plans to ensure that the students meet the course graduation requirements and acquire higher levels of L2 proficiency. The assumption is that the DA optimizes the learning process and success rate for each student. Because students have different strengths, weaknesses, and needs, the learning plan must be unique and personalized (Dennen, 2004).

Vygotsky proposed the ZPD as part of his sociocultural theory (Defense Language Institute/Continuing Education, 2012a; Vygotsky, 1978). Figure 5 is a

representation of the ZPD. The tasks a student can complete without assistance are contained within the green circle and represent fully developed skills. Tasks that a student cannot complete even with assistance are shown in red, and represent skills the student has not learned yet. The yellow zone, between the green and red areas, is the ZPD, which represents immature or developing skills that a learner needs assistance to complete. The returning linguist's intervention learning plan target this area, specifically where the linguist's performance starts to break down, or the upper threshold of his or her abilities (Applefield et al., 2000; Defense Language Institute/Continuing Education, 2012a; Dennen, 2004). The ZPD is not static but dynamic and shifts with the student's development (Dennen, 2004). DLI/CE's teaching teams use the ZPD to identify developing skills that are not fully mature and targets these areas to ensure proper maturation (Defense Language Institute/Continuing Education, 2012a). The learning plan becomes a shared goal between the teaching team and the student, a critical factor in the teaching-learning situation (Dennen, 2004).

A critical tool in executing the learning plan and achieving the shared goals is cognitive apprenticeship, which bridges the gap between constructivism's ZPD and cognitivism's skill retention theory. Cognitive apprenticeship is a derivative of Vygotsky's ZPD and is used when a master of a skill (teacher) provides scaffolding to assist an apprentice (student) in completing a skill that otherwise could not have been completed by the student alone (Applefield et al., 2000; Dennen, 2004). The master intentionally chooses complex tasks at the upper threshold of the apprentice's capabilities that can be accomplished only with the master's assistance and which promote relevant skill development (Applefield et al., 2000). Dennen (2004) defined scaffolding in L2 classrooms as:

- Offering an explanation
- Inviting student participation
- Verifying and clarifying student understanding
- Modeling desired behaviors
- Inviting students to contribute clues



Figure 5. Vygotsky's Zone of Proximal Development

In order to perform at the highest level, learners need to move skills and knowledge from stages one and two into stage three by proceduralizing declarative knowledge (Kim et al., 2011). Using the cognitive apprenticeship concept, a teacher identifies those skills that may be ready to move, either declarative or procedural, and creates opportunities for the student to practice and use these skills. The teacher provides the necessary scaffolding to assist the student in successfully completing the task (Dennen, 2004). As the student becomes more proficient, the teacher gradually fades out the scaffolding, until the student can accomplish the skill without any help (Dennen, 2004). This process can be used in all three stages of the skill retention theory.

In addition to cognitive apprenticeship, an important element in being a successful learner is metacognition, which has been defined by Livingston (1997, p. 1) as "higher order thinking which involves active control over the cognitive processes engaged in

learning,” or in other words, being able to control one’s learning by using cognitive strategies to ensure the greatest acquisition and retention of knowledge and skill. Students who are successful in acquiring an L2 utilize more metacognitive strategies, and use them in more appropriate situations than less successful students (O’Malley & Chamot, 1990). The teacher models appropriate metacognitive strategies, found in Table 2, for the students to emulate, with the goal of helping the students develop self-regulated learning and to become more efficient learners (Alhaqbani & Riazi, 2012; Applefield et al., 2000).

Table 2. Metacognitive Learning Strategy Definitions
(From O’Malley, Chamot, & Walker, 1986)

Metacognitive learning strategy	Definition
Advance organization	Previewing the main ideas and concepts of the material to be learned, often by skimming the text for the organizing principle
Directed attention	Deciding in advance to attend in general to a learning task and to ignore irrelevant distractors
Functional planning	Planning for and rehearsing linguistic components necessary to carry out an upcoming language task
Selective attention	Deciding in advance to attend to specific aspects of input, often by scanning for key words, concepts, and/or linguistic markers
Self-management	Understanding the conditions that help one learn and arranging for the presence of those conditions
Self-monitoring	Checking one’s comprehension during listening or reading or checking the accuracy and/or appropriateness of one’s oral or written production while it is taking place
Self-evaluation	Checking the outcomes of one’s own language learning against a standard after it has been completed

During the DA evaluation, students are asked to report any strategies they used to help them understand the material (Defense Language Institute/Continuing Education, 2012a). The student’s intervention learning plan will provide additional metacognitive strategies to use in order to increase the likelihood of success in the program. The DA

and the intervention learning plan assist learners in becoming active in their own learning and aids them in developing the skills necessary to construct their own knowledge instead of passively absorbing information (Turan, Demirel, & Sayek, 2009). These strategies may be vital in proceduralizing declarative knowledge and moving to the next ILR level.

E. SUMMARY

Foreign language skills are complex and may decay over time without practice or use. Despite much research conducted on L2 skill change since the 1980s, a general theory to describe L2 skill change has not been identified. Learning theories from behaviorism, constructivism, and cognitive psychology were explored to see which might provide the greatest explanatory power to the L2 change phenomenon. The skill retention theory, a variant of the three-stage skill acquisition theory from the cognitive psychology domain, was identified as having the greatest potential. This theory has been used to describe psycho-motor and cognitive skill acquisition, decay, and reacquisition. The first two stages of this theory describe how learners acquire declarative and procedural skills and transition these skills into long-term memory. These two stages also describe the decay of skill proficiency over time. The third stage of this theory describes skill proficiency that can be retained indefinitely with little decay. This stage may contain the proficiency level linguistic researchers have said a linguist must attain in order to enhance retention, but little empirical research has been conducted to identify this proficiency level.

The majority of military linguists returning to DLI for additional language training have experienced L2 decay. The DA employed by DLI/CE is used to help a linguist reacquire decayed skills and exceed their baseline scores. This is accomplished by using the ZPD and cognitive apprenticeship.

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III. METHODOLOGY

A. DESIGN CONSIDERATIONS

Researching the complex cognitive nature of L2 change requires a longitudinal study with many participants and the ability to control many variables (DeKeyser, 2007a). Limited time prevented that type of experimental design, so retrospective research using data captured by DLI/CE's DA was chosen to research this phenomenon.

In addition to using the DA results to determine how much L2 skill proficiency was lost following BC graduation, it was also used to determine the reacquisition of L2 skills, or savings effect, during follow-on language courses at three specific milestones: 1) course entry, 2) midterm, and 3) about 4 weeks before graduation. Since the DLPT and OPI are the official tests of record for all military linguists, the follow-on training DA scores, graduation DLPT, and OPI ratings were used to determine if there was indeed a savings effect. These data were also mined to reveal potential relationships between specific candidate independent variables, especially those that were considered significant to the skill retention theory, and the dependent variable, both of which are listed in Table 3.

Table 3. Independent and Dependent Variables

Independent Variables	Dependent Variable
Incubation period length	L2 proficiency change
Time since graduation	
L2 use during incubation period	
Basic course proficiency level	
DLAB scores	
BC grade point average (GPA)	
Language	
Language category	
Additional L2 training	
Gender	
Branch of service	
Rank	
Age	
Marital Status	

1. Independent Variables

a. Incubation Period

The incubation period, or the time between basic course graduation and returning to DLI for additional language courses in the language, was expected to play a significant role in determining L2 proficiency change. The incubation period for returning linguists to DLI/CE ranged from one month to more than 10 years, with the average period around five to six years. Gardner's constraint of no opportunities or pressure for language use during the incubation period were relaxed since the majority of DLI graduates were expected to use their newly acquired L2 skills in some manner in line with their duties.

b. L2 Use

Linguists who use their L2 skills should retain L2 proficiency longer than a linguist who do not use them (Edwards, 1977). Unfortunately, the DLI/CE language teaching teams did not or were not able to capture language use during the incubation period, so this independent variable's influence on the dependent variable could not be explored.

c. Basic Course Proficiency Level

According to the skill retention theory and the inverse hypothesis, a linguist who graduates the basic course with a high level of proficiency will maintain his or her L2 skills longer than a linguist who graduates with lower proficiency. To determine if linguists' proficiency levels are associated with L2 change, linguists who graduated at the same proficiency level for a specific skill were grouped together. These groups were then compared against one another to ascertain whether proficiency level influenced the amount of L2 change.

d. DLAB Scores

The DLAB is used to determine whether a military member has the aptitude to learn a foreign language and is required for all potential linguists prior to starting language training at DLI. Although it was not designed to determine which language a military linguist should study, the results from the DLAB are used to establish

what language category a linguist has the aptitude to learn (Petersen & Al-Haik, 1976). Language categories have different DLAB thresholds a linguist must reach in order to study languages in that category. Category I languages are the easiest for an English speaker to learn, and category IV languages are the most difficult. The minimum score required to enter DLI is 95. The language categories and the respective DLAB thresholds are:

Category I: 95

Category II: 100

Category III: 105

Category IV: 110

This means that higher DLAB scores are found in the higher categories of languages. The research used languages from categories III and IV and the scores from this battery were analyzed in an effort to reveal if there is a correlation between the DLAB results and L2 change.

e. Basic Course GPA

DLI studies have indicated that a student's basic course GPA is a good indicator of success on the basic course graduation DLPT (Association of the United States Army, 2010). DLI linguists with higher GPAs tend to score higher on the graduation DLPT and OPI than those with lower GPAs. The basic course GPA was used to determine what association it may have on L2 change.

f. Language

Since more than one foreign language was used in the analysis for change and reacquisition, each language became an independent variable. The languages were compared against each other in terms of the dependent variable.

g. Language Category

With the inclusion of additional languages, language category became an independent variable. Only two of the four language categories, III and IV, were represented in this study. It was expected that since category IV languages are more

difficult for English learners to acquire, linguists of category IV languages would lose their L2 proficiency at a faster rate than linguists of category III languages. This independent variable could not be tested since there were not enough languages from both categories to test.

h. Additional L2 Training

Official training scores were recorded in each student profile. These scores included: the basic course graduation scores and any follow-on course scores. Some linguists had additional official training opportunities beyond the basic course and the course contained in the DLI/CE dataset. These linguists were grouped together to see if their L2 retention was better than those who only had two training opportunities. A larger dataset containing over 19,000 linguists was also used to analyze what influence additional L2 training opportunities may have had on L2 change.

i. Gender

Gender was not expected to play a role in L2 change in this study. In a prior study on L2 acquisition, no difference was found between the two genders in listening, reading, and speaking skills at the end of language training (Ehrman, 1996). However, since gender was collected by DLI/CE, it was used in the analysis.

j. Branch of Service

Regardless of branch of service, all linguists must take the DLAB prior to entering DLI. Only those service members who show an aptitude for languages are permitted to enroll in DLI. If all other variables are held constant, branch of service should not have an impact on L2 change. It is unknown how each service uses its linguists, so this variable may affect L2 change. The small dataset could not be used since 160 of the 193 linguists were Air Force members; however, the large dataset was used to see if this independent variable was related to L2 change.

k. Rank

This variable was not expected to play a role in L2 change. However, because of the way this independent variable was collected by DLI and DMDC, it could not be used in the analysis. The rank of a returning student for a follow-on course overwrote the rank when the student was in the basic course. Without knowing the linguists' ranks when they came through the basic course, we cannot determine if this independent variable had any influence on L2 change.

l. Age

Studies have shown that learning advantages generally favor younger adult learners over older adult learners (Ehrman, 1996); however age was not expected to influence L2 change in this study, since the majority of basic course L2 learners are roughly the same age. In any case, age was inconsistently captured by DLI/CE, and the age that was captured was the age while attending the follow-on courses, not the basic course. Data from DMDC did not contain the linguist's age.

2. Dependent Variable

According to the skill retention theory and the inverse hypothesis, linguists who graduate with a higher level of proficiency will experience less L2 change than linguists who graduated with a lower proficiency. Two types of change were evaluated: 1) decay in L2 skills and 2) the reacquisition of these skills.

The decay in skills was captured at the end of the incubation period when the linguist returned for official L2 follow-on training. The diagnostic assessment scores provided a way to compare how much proficiency the linguist lost compared to the linguist's baseline and in what skills the loss occurred.

The reacquisition of these skills was evaluated at each diagnostic assessment interval. The official graduation score from the follow-on course was used as the final determinant in skill reacquisition. The DA and follow-on course scores were compared against the linguist's baseline scores to determine if the linguists reacquired or exceeded their original proficiency.

B. PARTICIPANTS

Since this research was a retrospective study, participants were not recruited or randomly selected. Participants were military linguists who graduated both the basic and follow-on language courses in Arabic, Chinese, Korean, Persian-Farsi or Russian from the Defense Language Institute. In many instances, these military members self-selected to be trained as linguists and demonstrated language aptitude by scoring at least the minimum required score for entrance into DLI. Data from each linguist's performance while at DLI was extracted from records kept by DLI and DMDC.

1. Problems with DLI/CE's dataset

In order to reduce the number of independent variables, the original research proposal suggested using only one language, Russian. It was estimated the dataset would contain between 1,000 and 2,000 Russian linguist profiles of students who had attended the Russian basic course and then returned for a follow-on course during the years 2005 through 2012.

Several problems were discovered with DLI/CE's DA Russian data during the encoding process. First, the dataset contained far fewer linguist records than anticipated. Second, there were excessive data gaps that prevented many of the student profiles from being included in the analysis. Third, after filtering out unusable student profiles, the sample size was too small to carry out any substantial analysis.

Figure 6 depicts the critical points a linguist's record needed to contain to be included in the analysis: 1) basic course graduation date and scores, 2) return date to DLI for a follow-on course and initial DA scores, and 3) graduation date from the follow-on language course and scores. These three data collection points are critical for L2 attrition studies, and follow the recommendations for language skill decay research as proposed by Clark (1982). The midterm and final DA scores, if recorded, were used to capture how quickly lost L2 proficiency skills were reacquired.

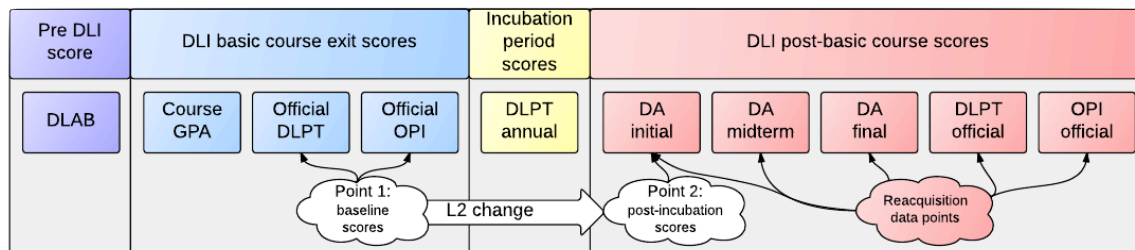


Figure 6. Critical Data Points Required for Language Change Research

Follow-on language courses, after the BC, include end of training enhancement (post-basic), refresher intermediate, advanced, and Defense Threat Reduction Agency (DTRA) training. A description of each course is found in Table 4.

Each proficiency measurement should include three scores, one each for listening, reading, and speaking. If the listening or reading scores were missing, the sample was discarded. In some cases, several student profiles did not contain an entry DA speaking score, but did have the listening and reading scores. In these instances, the sample was retained for the analysis since military linguists are tested annually on listening and reading comprehension but rarely on speaking.

In addition to the above-mentioned missing data, it was discovered that the exit scores from the DLI basic course, recorded by the DLI/CE teaching teams, were not official but self-reported by the students. In order to ensure only official scores were used, DLI provided official graduation DLPT scores and the dates the proficiency tests were administered for the basic and follow-on courses. This dataset contained over 16,000 linguists who had graduated a basic course in one of the five languages used in this research. These official scores and dates were compared against the scores reported by DLI/CE and changed to the official scores and dates if necessary. The DA proficiency scores are only used within DLI/CE and are not archived, so there was no way to verify them. They were encoded as reported.

Table 4. Description of DLI Follow-on L2 Courses
(From Defense Language Institute, 2011)

Follow-on Training	Description
End of Training Enhancement (post-basic)	Provides additional training for DLI students who did not meet the minimum proficiency requirements for graduation. Students selected for this course must be approved by their service and their BC teaching teams and are expected to achieve proficiency level 2 by the end of the course. This training must start within four months of BC completion.
Refresher	Designed to help linguists reestablish skill proficiency in skills that have recently dropped below 2/2/1+ (basic course graduation requirements). Students must have a listening, reading, or speaking score of at least 1 within the last 12 months. It is expected that students will increase a half step in proficiency in those skills that have decayed
Intermediate	Designed to help BC graduates improve their skills levels to 2+. Entering students should have taken the DLPT within the last year and achieved a level 2 in listening and one other skill.
Advanced	Designed to help intermediate graduates improve their skills levels to 3. Entering students should have taken the DLPT within the last year and achieved a level 2+ in listening and one other skill.
DTRA	Designed for Russian linguists who have been selected for a DTRA assignment. Speaking ability, interpreting and translating skills, and knowledge of current treaties are stressed. Entering students should have taken the DLPT within the last year and achieved a level 2 in listening and reading.

2. Additional Languages for Analysis

After filtering out all samples that were missing required data and ensuring all reported DLPT and OPI scores were official, there were only 65 complete records remaining for analysis. This small sample size necessitated opening the aperture to include more than one language. A larger sample size was obtained by including four additional languages: Arabic, Chinese, Korean, and Persian-Farsi. After completing the encoding process outlined earlier for these additional languages, there were 193 complete records.

These data provided by DLI/CE did not contain the annual proficiency scores of the linguists following their graduation from the basic course and prior to their return for

the follow-on training. An initial analysis of L2 loss using just three points recorded by DLI/CE produced very coarse results. In order to get a more complete picture of the L2 decay curve, a data request was submitted to the Defense Manpower Data Center (DMDC) to provide the annual proficiency scores of DLI/CE's 193 linguists within these five languages. A second request was submitted for all follow-on courses, graduation scores, and annual proficiency scores of the 16,000 linguists provided by DLI. Two datasets were provided by DMDC. One included the 193 linguists provided by DLI/CE and the other all 16,000 basic course graduates from fiscal year 1999 to fiscal year 2012. These two datasets were used to conduct this research.

After reviewing the annual tests scores provided by DMDC, it was apparent that very few linguists were given annual OPIs following graduation from the basic course. Listening and reading were the only skills that were tested annually. This meant that proficiency in speaking could not be analyzed. The only analysis performed on speaking used the scores from the three previously identified critical points: BC graduation scores, initial DA scores, and follow-on course graduation scores. The results for speaking are coarse, but show the L2 change over the incubation period and the reacquisition of the speaking proficiency.

The small dataset contained many independent variables captured by DLI/CE, discussed in Section A.1 of this Chapter, which were analyzed to see if they were associated with L2 change. This small dataset was also used to see if decayed language skills were reacquired faster in the follow-on than in the basic course, since the DA proficiency tests documented the linguist's increasing proficiency levels over the course of the follow-on training. The large dataset does not contain as many independent variables as the small dataset, but it does contain every annual proficiency score for each linguist. This large dataset was used to track yearly L2 decay for each linguist over time.

To graduate any L2 basic course from DLI, a linguist must score a 2/2/1+. The scores are based on the Interagency Language Roundtable (ILR) criteria (see Table 1). It was believed that data from students who did not achieve the required graduation scores were important for verifying stage one of the skill retention theory because their skill proficiency may have only been in the first stage. Even though these linguists did not

graduate DLI, the Utah Army National Guard (ARNG) and some Special Forces units still retain them. Prior to obtaining the DLI/CE data, the Utah ARNG agreed to provide data from some of its unqualified DLI graduates, with the hope that these data would validate the rapid L2 loss of proficiency in stage one as indicated by the skill retention theory.

After receiving and reviewing the ARNG data, it was determined there were not enough annual proficiency scores to evaluate whether unqualified DLI graduates rapidly lost their skills. This challenge was overcome by identifying linguists in the small and large datasets who did not meet graduation requirements. Data from these linguists were analyzed to see if their skills were in stage one and rapidly decayed following graduation from DLI.

C. PERFORMANCE MEASURES AND ASSESSMENT INSTRUMENTS

Most experimental tasks that study skill focus on measuring speed and/or accuracy of performance (Proctor & Dutta, 1995). This type of performance measurement is also done with L2 skills; however, the standard military language tests, the DLPT and the OPI, measure of proficiency. Scores for these tests are based upon the ILR scale, which do not reflect the speed or accuracy of the linguist, rather the proficiency level. A linguist's proficiency is determined by successfully accomplishing specific tasks tied to a specific ILR level (Herzog, n.d.-a).

The DLI/CE data contained scores from the DLPT, OPI, and DA instruments. The ILR proficiency rating scale used to determine a linguist's proficiency will first be discussed followed by short summaries of each of the assessment instruments.

1. Interagency Language Roundtable (ILR) scale

In a brief history of the ILR scale, (Herzog, n.d.-a) wrote that the scale was developed to determine a linguist's proficiency in speaking, reading, listening, and writing and has six base levels (0, 1, 2, 3, 4, 5), with 0 representing no functional ability and 5 representing skills equivalent to those of an educated native speaker. Attainment of any proficiency level implies control of L2 skills required for the previous levels. If a

linguist demonstrates proficiency that substantially exceeds the requirement for one level but does not fully meet all the requirements for the next level, a “+” rating, e.g., 2+, is assigned. This effectively makes an eleven-point scale to determine a linguist’s proficiency level.

The ILR scale levels are ordinal in nature. While ordinal variables can be listed in order, the distances between levels are not equal (Kerlinger & Lee, 2000). The ILR scale has been compared to an inverted triangle, with the lowest levels located at the bottom, and the highest levels at the top as depicted in Figure 7. Table 5 lists a few examples of the standards and skills required for levels 0 to 3. The standards and skills required to attain level 1 proficiency are not as difficult, nor as numerous, as the standards and skills required to attain level 3. The DLPT, OPI, and DA proficiency tests all use the ILR scale. The development of this standardized rating scale reduced the subjectivity of determining proficiency levels and created a framework by which to determine inter-rater reliability and led to a high degree of scoring consistency (Herzog, n.d.-b).

2. Defense Language Aptitude Battery (DLAB)

The DLAB is not a proficiency test; rather, it is a test used to determine a person’s aptitude in learning an L2. It is administered to members of the Armed Forces who desire to become linguists. The minimum score required by DLI for language training is 95, however each service may waive the score requirements (Defense Language Institute, 2011).

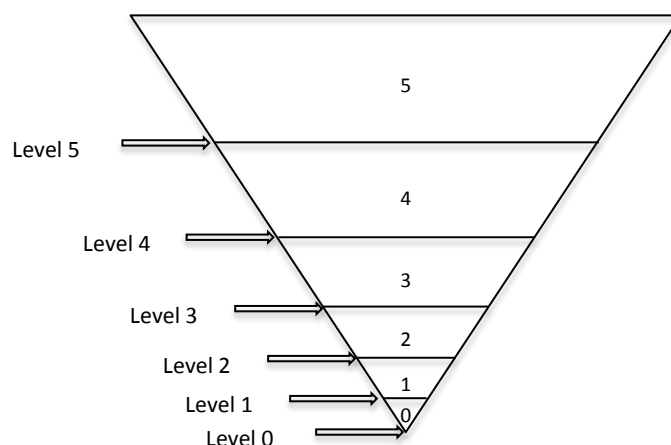


Figure 7. ILR Scale Shown as an Inverted Triangle Depicting Increasing Difficulty with Increasing Levels

Table 5. Interagency Language Roundtable Proficiency Standards for Level 0-3
(After Anderson, 1997)

Level	Function/Tasks	Context	Accuracy
3	<ul style="list-style-type: none"> – Support Opinions – Hypothesize – Explain – Deal with Unfamiliar Topic 	<ul style="list-style-type: none"> – Practical – Abstract – Special Interest 	Errors never interfere with communication and rarely disturb the native speaker
2	<ul style="list-style-type: none"> – Narrate – Describe – Give Directions 	<ul style="list-style-type: none"> – Concrete – Real-world – Factual 	Intelligible to native speakers even if not used to dealing with non-native speakers
1	<ul style="list-style-type: none"> – Question and Answers – Create with the language 	<ul style="list-style-type: none"> – Everyday survival 	Intelligible to native speakers with effort and practice
0	<ul style="list-style-type: none"> – No Knowledge to Memorized 	<ul style="list-style-type: none"> – Random 	Unintelligible

3. Defense Language Proficiency Test (DLPT)

This test has been designed to test the listening and reading proficiency levels of native speakers of English who have learned an L2 and non-native English speakers who possess strong English skills in reading and listening (Defense Language Institute, n.d.). There are two types of test formats: a multiple choice and a constructed response; both are computer-based. The DLPTs for the five languages in this research study are multiple-choice format, so the constructed response format will not be considered. Inter-rater reliability errors for the multiple-choice DLPT are not a concern since the test is administered and graded by a computer. Proficiency scores are determined by the number of correctly answered questions and there is no penalty for guessing (Defense Language Institute, n.d.)

4. Oral Proficiency Interview (OPI)

The OPI is used to assess the proficiency of linguist's speaking ability, and its strongest point is "measuring how well a person can function in real-life situations in a foreign language according to well-defined linguistic tasks and assessment criteria" (Defense Language Institute, 2007, p. 1). The test administrators must pass intensive training to normalize their rating techniques and be certified in order to reliably assess a linguist's speaking proficiency and to keep the inter-rater reliability index as high as possible (Defense Language Institute, 2007).

5. Diagnostic Assessment (DA)

Since 2006, DLI/CE has been using an in-house developed DA tool to assess, among other things, the strengths and weaknesses of follow-on course students' proficiency in reading, listening, and speaking (Defense Language Institute/Continuing Education, 2012b). The results of the DA are used to develop individualized training plans and to track the skill progress of military linguists in each of the three modalities. These data captured by the DA are to be locally archived, and a complete student profile should contain all of the following information:

- Basic demographics (name, branch of service, rank, age, marital status)
- Basic course completion scores if applicable

- DA sample pre-interview summary sheet (Appendix G)
 - E&L Learning Style Questionnaire (Appendix H)
 - Personality Type Questionnaire (Appendix I)
 - Barsch Learning Style Inventory (Appendix J)
 - Motivated Strategies for Learning Questionnaire (Appendix K)
- Learning plan (Appendix L)
- Initial-, mid-, and final-DA results for listening, reading, and speaking
- Official course completion scores

The DA is a formative assessment tool used by the teaching teams to develop a personalized intervention-training plan, or learning plan, for each student. These assessments are administered throughout the course to determine a student's understanding of the subject material and the results are used to adjust the teaching plan to ensure the student achieves the goals of the training. Summative assessments, e.g., DLPT and OPI, on the other hand are evaluations of learning and are used to determine an official proficiency level for the linguist.

The DA is designed to assist the teaching team in identifying what skills a linguist is missing to be proficient at the next ILR level. The results from this assessment are used to craft an individual study plan to attain the course goals and advance the student to the next level. The ILR scale is used in the DA, but in order to further differentiate the reading, listening, and speaking skills of the linguist, each level is divided into three categories, low, mid, and high, e.g., 2+ low/mid/high, with a “low” corresponding to a linguist achieving 70 percent comprehension, “mid” 80 percent comprehension, and “high” 90 percent and above comprehension (Defense Language Institute/Continuing Education, 2012b).

The DA is conducted at three time periods during the follow-on training: 1) course entry, 2) midterm, and 3) roughly four weeks before graduation. During course entry, the student is administered the E&L learning style questionnaire, personality type questionnaire, Barsch learning style inventory, and Motivated Strategies for Learning Questionnaire. The results of these questionnaires are entered on the Summary of Pre-Interview Data and used by the teaching team in helping the students understand how

they can most effectively learn the L2 and succeed during the course. Below are short summaries of each of these tools used in the DA.

a. *E&L Learning Style Questionnaire*

Ehrman and Leaver (2003) developed a new cognitive styles model, E&L model, to increase the effectiveness of intensive language training, like that found at DLI/CE. Table 6 lists the ten subscales of the E&L “superordinate construct, *synopsis-ectasis*,” where synoptics “trust their guts,” and ectenics do not normally do so (Ehrman & Leaver, 2003, p. 395). The questionnaire elicits self-reported behavior from the linguists to determine what their cognitive style preferences are, which the teaching team uses to suggest strategies to the linguist on how to best achieve the course goals.

Table 6. E&L Model’s Superordinate Construct and Ten Subscales

Synoptic	Ectenic
Field Sensitive	Field Insensitive
Field Independent	Field Dependent
Leveling	Sharpening
Global	Particular
Impulsive	Reflective
Synthetic	Analytic
Analogue	Digital
Concrete	Abstract
Random	Sequential
Inductive	Deductive

b. *Personality Type Questionnaire*

The Myers-Briggs Type Indicator (MBTI) is perhaps the most widespread personality type indicator and is administered to the returning linguists for personality typing (Leaver, Ehrman, & Shekhtman, 2005). Based on their answers, linguists are placed in one of sixteen possible personality types. These types are based on four personality features that have two opposite preferences. The theory behind the MBTI states that everyone has an inclination to use one of the preferences over the other; the MBTI helps to identify which one the linguist prefers (Leaver et al., 2005). These four

personality features are: 1) extraversion and introversion, 2) sensing and intuition, 3) thinking and feeling, and 4) judging and perceiving.

c. Barsch Learning Style Inventory

This inventory helps identify the learning preferences of the linguist, which can be visual, auditory, or kinesthetic. Based on their learning preferences, the teaching team can encourage students to study in a way that capitalizes on their preferences. For instance, the teaching team might suggest that a linguist who is a kinesthetic learner walk while studying flashcards.

d. Motivated Strategies for Learning Questionnaire (MSLQ)

Motivation and attitude have been shown to play an important role in the acquisition of language (Gardner, Lalonde, & MacPherson, 1985). The MSLQ was developed in the 1980s to help assess a student's learning strategies and motivation, with the end goal of helping students improve their learning skill (Duncan & McKeachie, 2005). Since the MSLQ is modular, DLI/CE extracted out the motivation section, which consists of 31 questions. There are six subsections within the motivation section: 1) intrinsic goal orientation, 2) extrinsic goal orientation, 3) task value, 4) control of learning beliefs, 5) self-efficacy for learning and performance, and 6) test anxiety. The results of the MSLQ are also used in developing the learning plan for the student.

D. WEAKNESSES OF RETROSPECTIVE RESEARCH

There are some inherent weaknesses with retrospective, observational or non-experimental, research. Three major weaknesses are: 1) independent variables can be measured but not manipulated, 2) randomization is not possible, and 3) there is a risk of improper interpretation of the results (Kerlinger & Lee, 2000; Watt & van den Berg, 2002). Each of these weaknesses will be addressed as it concerns the research. In addition, threats to internal and external validity will be addressed.

1. Variance

Variance in independent variables in retrospective research comes about through natural processes, not through manipulation (Watt & Van den Berg, 2002). Several potential problems with variance of independent variables were identified prior to this research.

a. Type of L2 Training

The type of L2 training can vary from high school and university language classes to study-abroad programs, and can also vary by intensity. This variance was reduced as much as possible by limiting this study to linguists who learned their L2 by attending a basic language course at DLI. Any linguist who did not have a basic course graduation date and score was eliminated from the analysis.

b. Post graduation L2 Use

L2 use following graduation from the basic course will vary between linguists. It was hoped that the teaching team would capture the L2 usage, but these data were not present in any of the student profiles. If these data had been captured, the students could have been divided into usage groups, i.e., low, medium, or high. DMDC's data contained the Military Occupational Specialty or Air Force Specialty Codes of each of the linguists, which provided a hint whether the L2 skills were required for the job, but did not enable the data to be divided into usage groups.

Linguists who use their L2 skills may only operate at low proficiency levels compared to other linguists. This would tend to cause a regression of the linguist's proficiency. This independent variable may cause additional noise and skew the results, especially in the small dataset. The larger dataset helps reduce the effect of this variance.

c. Heritage Speaker or L2 Learned Outside of DLI

If students were known to be L2 heritage speakers, learned the L2 in their home when children, or to have learned the L2 outside of DLI, they were dropped from the analysis since their L2 skills have the potential to skew the attrition and reacquisition

results. The DLI/CE data rarely captured this variable, so very few observations were removed from the analysis. It is believed that there were not any of these linguists included in the analysis, because students who demonstrate a high enough proficiency in a language are generally not enrolled in a basic course (Defense Language Institute, 2011); without a basic course score, a linguist was not included in the analysis. It is acknowledged that the analysis may still have included a small number of heritage speakers or learners of an L2 outside of DLI, since the DLI/CE teaching teams did not annotate this information; this may add additional noise to the results.

d. Different Language Categories

DLI has divided the languages it teaches into four categories, depending on the difficulty an English speaker has in learning the language. Category I languages are considered the easiest to learn, while category IV languages are the most difficult. The more difficult the language, the longer the course (Defense Language Institute, 2011). An attempt was made to use just one language for the analysis; however, there were not enough data points from Russian. To increase the number of samples, data from other languages were used; Russian and Persian-Farsi are rated category III languages, while the additional languages of Chinese, Korean, and Arabic are category IV. Regardless of language category, students in different languages should all graduate at the same rate (Association of the United States Army, 2010). Expanding the number of languages introduced additional independent variables of language category and language.

e. Varying Proficiency Levels

Linguists graduate the basic course with varying levels of proficiency, which according the skill retention theory should influence the rate of proficiency change. Linguists with similar proficiency scores were grouped together to evaluate whether proficiency levels influence L2 change. This grouping was done with both datasets.

f. Incubation Periods

The incubation period between linguists varied from 1 to 140 months with the average around 60 months, or 5 years. To determine if the length of the incubation period played any role in L2 skill loss, linguists were divided into similar incubation groups and then compared.

g. Selection for Follow-on Training

Only a few linguists return for follow-on training at DLI. The selection criteria the individual services may have used to select these linguists is unknown and depends upon the respective services' mission needs. Since the DA did not capture the selection criteria, there is no way to know how this may affect the analysis results.

2. Randomization

The inability to randomize prevented applying a treatment to one group of linguists and not another. To overcome this challenge, if the linguists in the datasets could have been divided into groups, this was done to compare one group against the other, i.e., attended a follow-on course or did not.

3. Improper Interpretation

Inter-rater reliability is always an issue when multiple evaluators interpret a subject's performance. To enhance inter rater reliability, the research initially focused on one language, Russian. The data pool was not large enough for a complete analysis, so other languages were included. While all evaluators are trained to the same ILR standards, having more evaluators means the inter-reliability may not be as high and may add additional noise to the data; however this should only affect the DA and OPI scores since the DLPT is a controlled, computer-based multiple-choice exam.

4. Threats to Internal Validity

Internal validity comes from a research design that clearly tests the research hypotheses by taking into account all variables that might influence the dependent variable. In general, retrospective research has low internal validity but high external

validity (Watt & Van den Berg, 2002). Four items have been identified as potential internal threats to the validity for this research: history, maturation, measurement instrument learning, and DLPT changes.

a. History

Significant events between proficiency measurements can impact a linguist's performance on the proficiency evaluations. For instance, following the terrorist attacks on 11 September 2001, linguists were internally motivated to learn or maintain their L2 skills needed in the war on terror. This may have had a positive effect on L2 acquisition and maintenance in the years immediately following the attacks. The history threat is difficult to deal with in retrospective research since independent variables cannot be controlled. To attempt to reduce this threat, the sample size was increased to include as many linguists as possible.

b. Maturation

Subjects of any longitudinal research will change over time, which may have an effect upon the results. For instance, a linguist may develop better study habits, which will produce more favorable measurements (Hansen et al., 2002). These changes in a linguist should not be confused with changes in the independent variables. A large sample size and comparing subjects to themselves may help to reduce this internal threat.

c. Measurement Instrument Learning

Linguists are tested annually to receive foreign language proficiency pay. Often, the same testing instrument is used to measure proficiency year after year and linguists may begin to learn the test. The DLPT 5 is supposed to limit test learning by introducing new questions; however, a linguist taking the same test every year may recognize repeat questions and perhaps remember potential answers, which may cause scores to improve over time, or decrease more slowly than they would have otherwise. This learning, or slower decay, should not be confused with changes in the independent variables. In retrospective research, this threat cannot be controlled but is acknowledged.

d. Change from DLPT 4 to DLPT 5

The incubation period of some linguists spans more than ten years, and during this time the DLPT transitioned from version 4 to version 5. The change in the testing instrument may cause a dip in scores until the linguists become familiar with the new test. In one instance, the release of Arabic DLPT 5 caused most Arabic linguists to fail until the test was withdrawn and the scoring mechanism recalibrated (Cavallaro, 2007). Additionally, some older linguists may have taken a paper and pencil test instead of the computer-based version. These paper tests were scored by hand, and the chance for the proctor making a scoring mistake was higher. Increasing the sample size may help to reduce this threat.

5. Threats to External Validity

External validity refers to the generalizability of the research conclusion and its application to the real world; the outcomes of valid external research can be used to help determine the dependent variable's behavior (Watt & Van den Berg, 2002). Two external threats have been identified: 1) representativeness of sample and 2) reactive effects of setting.

a. Representativeness of Sample

The pool of subjects may not be representative of society or of linguists as a whole. These subjects are different from linguists outside the military in that they volunteered to join the military, self selected to train as a linguist, and passed a language aptitude test. As a result, this study may not be a reflection of linguists outside the military. A large sample size may reduce this potential error, but will not eliminate it.

b. Reactive Effects of Setting

Experimental research should be done in an environment that closely resembles the real world to get the best results. The military assessment instruments for language proficiency are done in controlled environments for test security issues and may cause the subject to not perform as well as they would in a more natural setting. There is

no way to alter where the testing takes place, so this threat must be acknowledged as potentially skewing the results from what would be observed in the real world.

E. SURVIVAL ANALYSIS

Survival analysis is a statistical method used to analyze longitudinal data on the occurrence of a specific event. A group of people sharing a common characteristic, in this case linguistic training from DLI, makes up a cohort. For this research, each linguist within a cohort was followed until a specific event, proficiency decay to a certain level, at which point the linguist is no longer included in the analysis.

The objectives of survival analysis are to: 1) determine the time-to-event for a cohort, 2) compare the time-to-event between two or more groups of people, and 3) assess other variables associated with the time-to-event (Allison, 2003). Allison (2003) defined several terms used in survival analysis:

- Time-to-event is the time from the entry into the study until the participant has a particular event.
- Censoring to the participant occurs if he/she does not participate in a follow-up after beginning the study or drops out of the study. The participants are treated as though the event did not occur while they were in the study.
- Right censoring occurs when the study terminates before all the participants have reached the event. The event may occur after the termination of the study, but the researcher will not know this.

There are four assumptions that are made when conducting a survival analysis (Norman & Streiner, 2000, pp. 242–243).

- There is an identifiable starting point. For this research, the starting point is the linguist's graduation from the basic course at DLI.
- There is a defined endpoint. This endpoint can occur at different times. For linguists, this endpoint event occurs when they fall to a predetermined proficiency level. A linguist's proficiency can change up and down over a period of time, and to deal with this variance, we established a rule that a linguist's endpoint is the first time they fall to or below a certain proficiency level; this will be defined as the terminal event. The rest of the linguist's proficiency data were not used in the analysis following a terminal event. A linguist's endpoint may also be when he or she stops taking the DLPT or leave the service.

- Loss to follow-up study should not be related to the outcome. When a linguist stops taking the DLPT or leaves the service, the linguist's proficiency skills are no longer recorded. The loss of the linguist for any other reason than reaching the endpoint should not be treated as an event. Up until the point of departure, the linguist was still qualified and should be treated as such.
- There is no secular trend. The requirements to become part of a study that is longitudinal should not change over time; otherwise the participants at the beginning of the study might differ from the participants at the end of the study and the results would not be valid. The rules for the study are that all linguists must have graduated a DLI basic course in one of the five listed languages. If the linguist's records contained the required data points, he or she was included in the analysis.

Data from this type of analysis can be depicted with a Kaplan-Meier approach, from which the median (50 percent of the cohort triggered the event), and the mean (average time to event) can be derived (Spruance, Reid, Grace, & Samore, 2004). This type of analysis is appropriate for a retrospective cohort study on L2 change since it takes time into consideration, accounts for censoring, and may allow an analysis to be done of the independent variables against the time-to-event. It also allows for comparing two or more proficiency groups against each other. A survival analysis can be used to find the probability of an individual reaching the event at a certain point in time. Survival analyses can become unreliable towards the end of the study since there are fewer participants left to have an event (Allison, 2003).

F. COX REGRESSION ANALYSIS

There are several methods for analyzing time-to-event survival curves, one being the Cox model. This model is a regression method for survival data (Spruance et al., 2004). The Cox regression model can be used for analyzing censored survival data and allows for testing covariates, or independent variables, and how they influence the survival curve (Gill, 1984). This model produces a hazard ratio, which in terms of this study, is the ratio of the hazard rate of the number of linguists who have a terminal event from among those linguists who did not. In the basic Cox model, the hazard ratio is assumed to be constant across time. The hazard rate is the probability that if the event that is being studied has not already occurred, "it will occur in the next time interval,

divided by the length of that interval,” which has been made very short so that it is an instantaneous rate (Spruance et al., 2004, p. 2787).

The Cox model assumes that the hazard rates associated with the different levels of the predictors (language in some cases, second course in others, and so on) are proportional across time. This assumption can be examined with a test due to Grambsch & Therneau (1994), implemented in the `cox.zph()` function in R’s built-in `survival` package. This function tests the null hypothesis that a time-varying coefficient entered into the model would have a slope that is not statistically significantly different from zero. At the usual significance level of 0.05, that hypothesis was rejected in only one of about twenty models. Therefore we conclude that the proportional hazards assumption is reasonable for this data.

G. DATA MANIPULATION

The small dataset containing 193 linguists was manipulated and modeled using JMP Pro 10 (SAS Institute Inc., 2013). Data manipulation and modeling on the large dataset, 16,000 linguists, was performed in the statistical environment R (R Core Team, 2012).

The survival analyses and Cox model represented time in days since graduation. Table 7 provides a quick conversation for many of the analyses done in Chapter V.

Days	Years and Months
1000	~ 2 years 9 months
2000	~ 5 years 6 months
3000	~ 8 years 3 months
4000	~ 11 years
5000	~ 13 years 9 months

Table 7. Conversion from Days to Years for Survival Analyses and Cox Model

IV. FINDINGS AND DISCUSSION

1. Research Hypotheses

The four hypotheses for this dissertation research are:

- H₁. Second language skills are an instance of sensory-motor or cognitive skills and therefore a variant of the three-level skill acquisition theory can be used to explain relationships between language skill variables and L2 change.**
- H₂. Decayed L2 skills can be reacquired at an expedited rate as indicated by the skill retention theory.**
- H₃. There is a specific L2 proficiency level that must be acquired to extend retention and reduce skill decay.**
- H₄. The Diagnostic Assessment (DA) tool used by the Defense Language Institute, Continuing Education Directorate (DLI/CE) can identify L2 skills that are ready to transition from declarative to procedural knowledge.**

2. Overview of Chapter

This chapter will discuss the findings of the L2 change research conducted on data collected from DLI to demonstrate that the results support the first three hypotheses and produce inconclusive results for the last hypothesis. The first section of this chapter will present the initial data analysis from the small dataset. The discussion will include how the initial results shaped the remainder of the research and the data.

Following the initial analysis, the next section will present the independent variables that were thought to influence the dependent variable of L2 change. This section's main purpose is to demonstrate that second language skills are similar to sensory-motor or cognitive skills and can be modeled by skill retention theory. Several independent variables: incubation period, proficiency level, and GPA, were investigated because of potential importance in the skill retention theory.

The next section will present the findings that support hypothesis two, which is that decayed L2 skills are reacquired at a faster rate than they were originally learned. These results add further support to the skill retention theory and the savings effect.

Only two prior researchers, discussed in Chapter II.A.4, have identified a specific proficiency level that linguists must attain in order to retain their L2 proficiency as long

as possible. Using the results from the small and large datasets that analyzed the retention of L2 proficiency by follow-on course, a specific proficiency level is offered. Additionally, a significant finding regarding L2 proficiency retention is presented.

The last section presents the results of the DA tools. The DA is the main instrument used to help the returning linguist attain the course goals and to recapture decayed skills. Inconsistent record-keeping prevented hypothesis four from being fully investigated. Testimonial evidence from teaching teams lends support to this hypothesis, but no statistical evidence is presented. The results from the analysis for this hypothesis are deemed inconclusive.

3. Initial Analysis

To aid in reading many of the charts in this chapter, the numerical coding developed by the ILR to represent the various skill levels is used, and is shown in Table 8. As the DLI/CE linguist data were encoded, a stoplight coloring system depicted the linguists' proficiency levels over time; a small sample of this stoplight chart is shown in Table 9. Skills that exceeded the graduation standards were colored green. Those that met the standards were colored yellow, and those that were below standards were colored red. Very quickly we were able to observe the decay of the linguists' proficiency during the incubation period and the recovery of these skills after the follow-on course.

A breakdown of the 193 linguists' basic course scores by proficiency level, language category, and skill is shown in Table 10. Only 16 linguists who failed to meet the minimum criteria for graduation (underlined) were sent back for follow-on course training. While this group is small, it provides interesting insights into the skill retention theory, especially regarding the first stage of learning, which will be discussed later in this chapter.

Table 8. Numerical Coding Chart for Each ILR Level (After Herzog, n.d.-b)

ILR Proficiency Score	Numerical Representation
3	30
2+	26
2	20
1+	16
1	10
0+	6
0	0

Table 9. Linguist's Proficiency Change Stoplight Chart Comparing Basic Course, Initial Diagnostic Assessment, and Follow-on Course Proficiency Scores

Basic Course Proficiency Scores			Diagnostic Assessment Scores			Follow-on Course Proficiency Scores		
Listening	Reading	Speaking	Listening	Reading	Speaking	Listening	Reading	Speaking
30	30	26	22	25	20	30	30	20
30	30	20	20	20	16	26	30	20
30	30	20	15	20	20	30	30	26
30	30	20	18	18	16	30	30	20
30	30	20	19	20	13	30	30	20
30	30	20	12	16	15	30	30	26
30	30	20	19	22	16	30	30	16
30	30	20	19	19	17	30	30	20
30	30	20	19	20	17	30	26	20
30	30	20	10	15	16	30	30	20
30	30	20	26	26	20	30	30	20
30	30	20	20	20	10	30	30	20
30	30	20	16	16	13	36	30	26
30	30	20	26	26	20	30	30	30
30	30	20	20	16	16	26	26	26
30	30	20	10	16	10	26	26	20
30	30	20	20	26	20	30	30	30
30	30	20	17	20	16	36	30	30
30	30	20	26	26	20	30	30	20
30	30	20	26	26	26	30	30	26
30	30	16	20	26	20	30	30	26
30	30	16	17	23	19	36	40	20
30	30	16	19	19	19	30	30	20
30	30	16	20	20	16	26	30	20
30	30	10	16	17	13	30	30	16
30	30	10	16	16	16	30	30	20
Green to Dark Green - Exceeded Basic Course Proficiency Standards								
Yellow - Achieved Basic Course Proficiency Standards								
Red to Dark Red - Below Basic Course Proficiency Standards								

Table 10. Number of Basic Course Linguists in Small Dataset Grouped by L2 Proficiency Level and Subdivided by Language Category

BC proficiency achieved (baseline)	Listening Total (Cat 4/Cat3)	Reading Total (Cat 4/Cat3)	Speaking Total (Cat 4/Cat3)
3	43 (19/24)	56 (34/22)	0
2+	71 (43/28)	91 (58/33)	2 (1/1)
2	69 (58/11)	44 (36/8)	103 (65/38)
1+	<u>10</u> (10/0)	<u>2</u> (2/0)	84 (63/21)
1	0	0	<u>4</u> (1/3)
Total	193 (130/63)	193 (130/63)	193 (130/63)

We made three different plots of the 193 linguists' listening skill scores. The first one depicts the incubation and reacquisition period, Figure 8; the second depicts the incubation period only, Figure 9; the third depicts the reacquisition compared to the original BC scores, Figure 10. The graduation date from the basic course was considered time 0 for each linguist. Several interesting things are apparent in Figure 8: 1) the majority of linguists lost proficiency during the incubation period, 2) the intervention, or follow-on courses, helped to return most linguists to their original baseline scores, and in some cases exceed these scores, in less time than the BC, 3) all levels, except for level 3, contained some linguists who improved their baseline scores during the incubation period, and 4) individual differences within these groups varied substantially. This same pattern is observed in plots for reading, Appendixes A, B, and C, and for speaking, Appendixes D, E, F.

Initially the decay slope of the higher-level groups appeared to be much steeper than the lower level groups. This outcome seemed to indicate that the linguists who graduated with the highest proficiency were losing their proficiency at a faster rate than those who graduated with lower proficiency. One possible explanation for this apparent phenomenon comes from the skill retention theory.

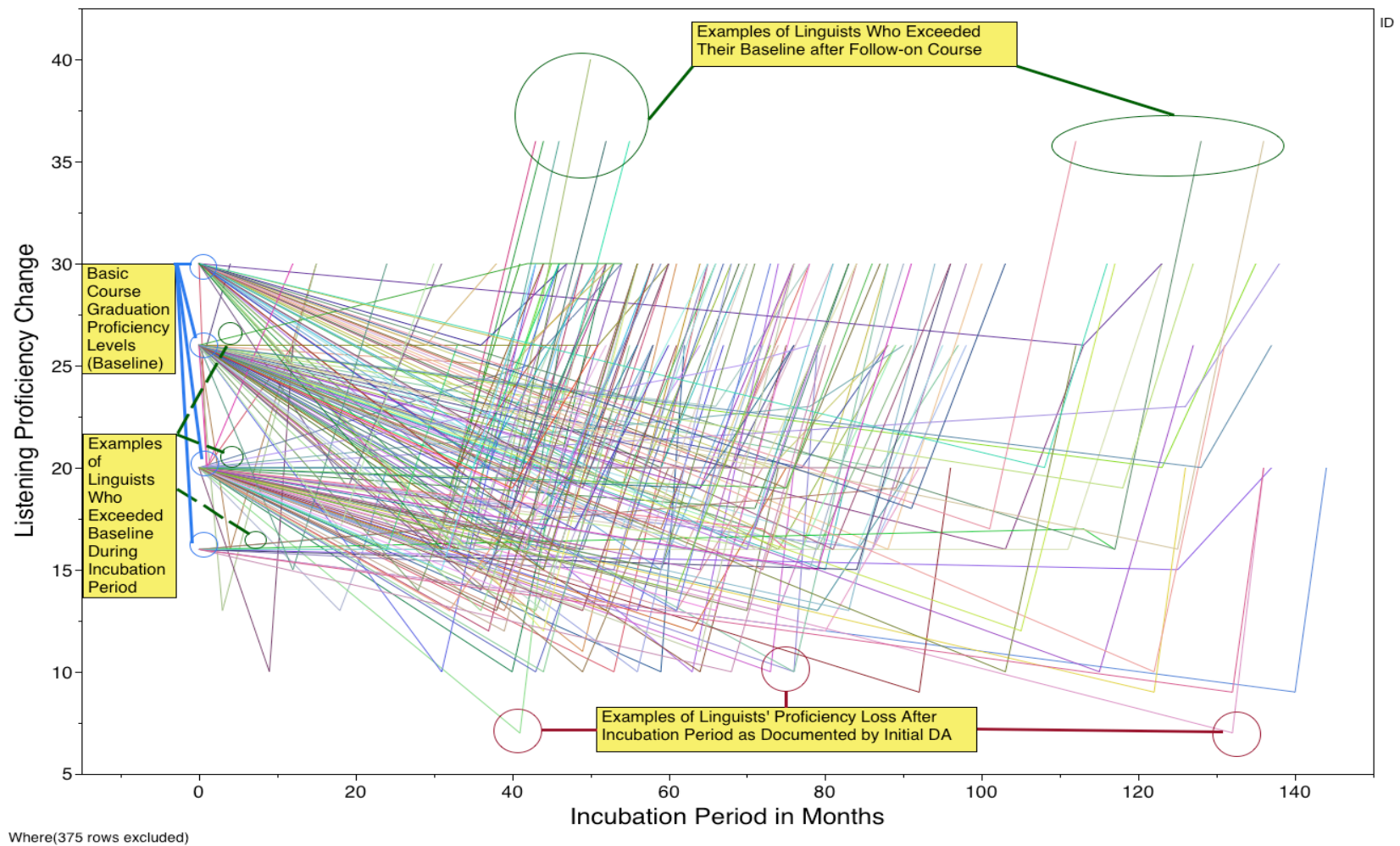


Figure 8. Listening Proficiency Decay During Incubation and Reacquisition During Follow-on Course

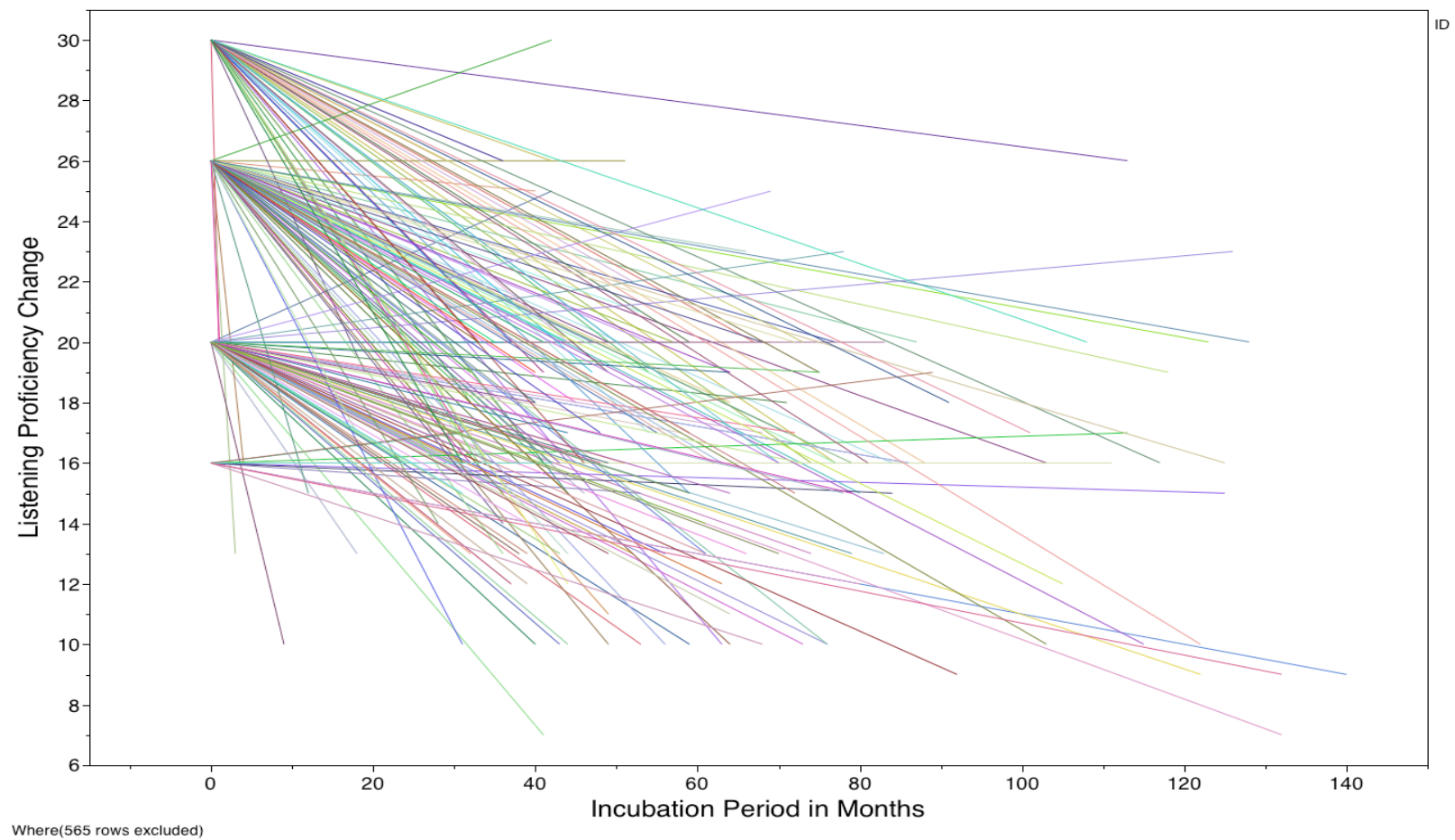


Figure 9. Listening Proficiency Change Based on Difference from Baseline Scores and Initial Diagnostic Assessment Scores

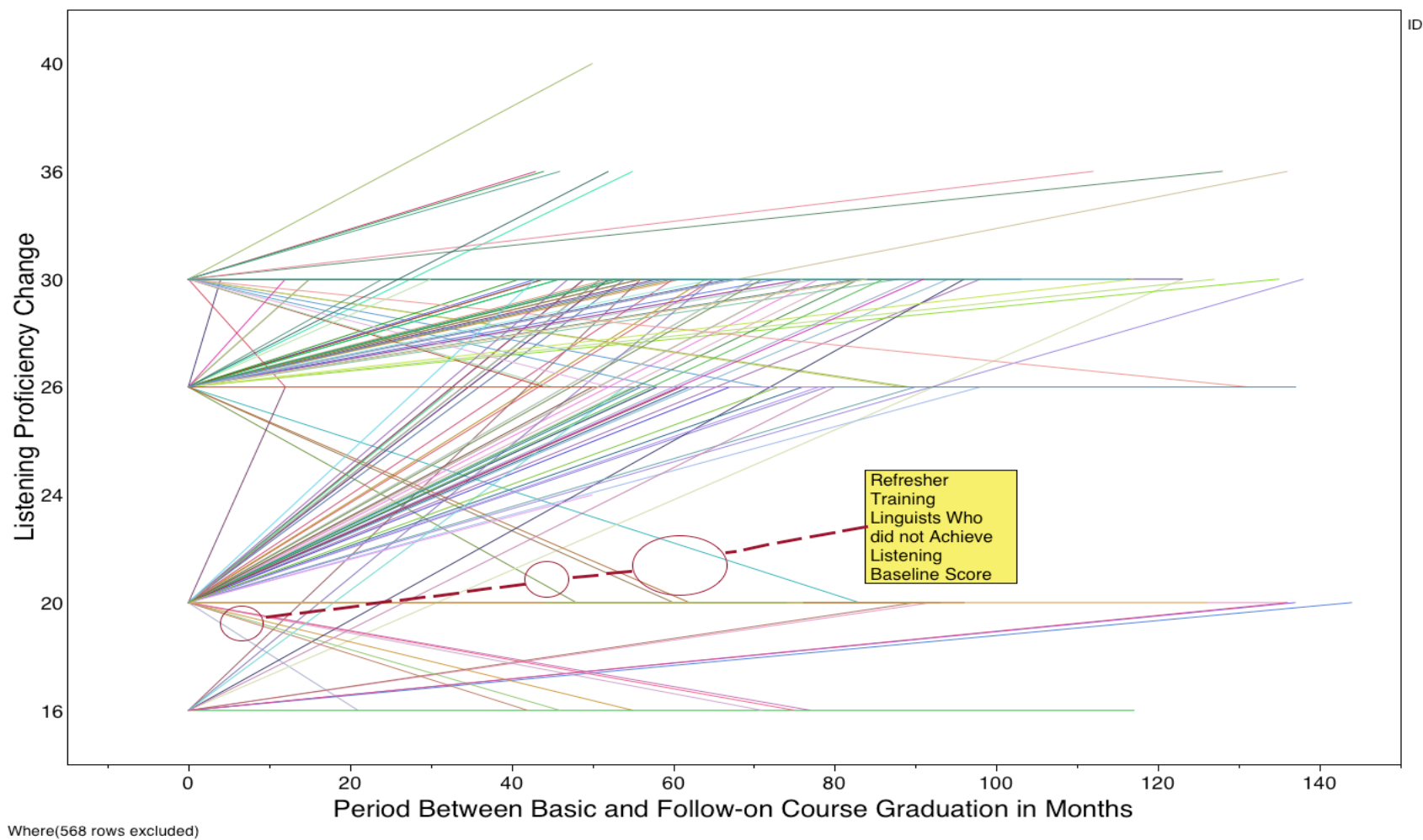


Figure 10. Listening Proficiency Change Based on Difference from Baseline Scores and Follow-on Course Scores

As discussed in Chapter III.C.1, the ILR scale is ordinal in nature. To obtain a 3 level in any of the L2 skills, the linguist needs to gain more knowledge and skill than was required for the prior levels. At level 3, the linguist should know how to support an opinion, read between the lines, and other subjective skills, whereas at lower levels, the linguist can get by with more objective knowledge and skills, i.e., memorized vocabulary and survival skills. Skills at level 3 are just beginning to develop at the end of the BC, and according to the skill retention theory, this knowledge is declarative. As the linguist begins to increase in proficiency, the lower level skills, with continued practice, will begin to proceduralize, making them immune to decay. If the linguist has built up enough declarative knowledge at level 3 by the end of the BC, then that linguist may achieve ILR level 3 scores on the DLPT and OPI. Newly developed ILR level 3 declarative knowledge requires continued intensive use to be maintained; however, this type of training is not received during follow-on technical training.

Once linguists graduate DLI, the intensive L2 training stops and decay starts to take effect, sometimes as soon as their technical training, which immediately follows DLI graduation. One study found that linguists lost up to 25 percent of their language proficiency during this technical training, and another study found that 30 percent of those linguists did not regain the proficiency they lost while at technical school during their operational assignments (United States General Accounting Office, 1994). This decay should only affect those skills that have not been proceduralized at the time of DLI graduation.

One possible explanation why linguists who lose proficiency during technical training never gain it back may be that the majority of linguist operational jobs only require skill levels around 1+ to 2 (Association of the United States Army, 2010; Wilson, Evans, & Harris, personal communication, February 5, 2013) and the declarative knowledge these linguists acquired while at DLI is quickly lost. Operating around 1+ or 2 may explain why none of the linguists at level 3 increased their skills during the incubation period. They may not have been in jobs that demanded they operate at or maintain level 3 skills.

This explanation may also be the reason why some of the lower-level linguists, as shown in Figures 8, 9, and 10 and Appendixes A-E, improved their proficiency during the incubation period. These linguists, some who graduated below DLI graduation requirements, were perhaps operating at a higher proficiency level during their operational assignment. Working just above their basic course proficiency level may have stretched linguists' abilities and helped to increase their L2 skill proficiency level.

B. ANALYSIS OF INDEPENDENT VARIABLES

1. Basic Course Proficiency Level

The purpose of this section is to demonstrate that proficiency levels are associated with L2 change. Several L2 change hypotheses, described in Chapter II.A.5, have posited that the higher proficiency a linguist achieves, the longer the linguist will maintain those proficiency skills. These hypotheses are similar to the skill retention theory, which posits that the higher the stage of learning students are in, the longer the knowledge they acquire will be retained.

The small dataset containing the 193 linguists was analyzed to determine if BC high-proficiency linguists lost more proficiency, during the incubation period, than the lower-proficiency linguists, as Figure 8 appears to depict. Linguists were grouped together based on their BC proficiency scores, i.e., all level 3 listeners were grouped together. If there were 30 or more linguists in a group, the median of each of the three proficiency skill scores was taken compared against the other groups' skill proficiency scores, Table 11. In each case, the group with the higher ILR proficiency is a specific skill did not fall below the lower-level group's proficiency in the same skill by the end of the incubation period. The higher proficiency basic course groups, after the incubation period, retained a larger proportion of high proficiency linguists than the next proficiency level down, demonstrating that there is an association between L2 proficiency level and L2 decay.

By course completion, the groups had all reacquired their baseline proficiency, and in some cases exceeded them. The groups did not switch order. The highest proficiency BC groups were the highest proficiency groups after the follow-on course.

Within the groups there appears to be a difference between proficiency levels that was not discernable in the plot. These results follow the skill retention theory's claim that higher proficiency skills are retained longer; however, comparing medians is not enough to claim there may be a difference. We decided to use the larger dataset containing 16,000 linguists to reduce some of the noise in the data and perhaps find a clearer difference between each proficiency level.

Table 11. Median L2 Change by Skill and Proficiency Level. Listening, Reading, and Speaking Scores are Displayed as Follows: Numerical Score/ILR Score (see Table 8). Time is in Months Since Basic Course Graduation Date

Skill:Level	DLAB	BC GPA	Time 1	L1	R1	S1	Time 2	L2	R2	S2	Time 3	L3	R3	S3	GPA	N
Listen: 3	116	3.62	0	30/3	30/3	20/2	56	18/1+	20/2	16/1+	68	30/3	30/3	20/2	3.6	43
Listen: 2+	114	3.52	0	26/2+	26/2+	20/2	56	16/1+	20/2	16/1+	67	30/3	30/3	20/2	3.65	71
Listen: 2	116	3.26	0	20/2	26/2+	16/1+	57	15/1	16/1+	15/1	67	26/2+	26/2+	20/2	3.48	69
Listen: 1+																10
Read: 3	116	3.58	0	26/2+	30/3	20/2	60	18/1+	20/2	16/1+	71	30/3	30/3	20/2	3.74	56
Read: 2+	115	3.45	0	26/2+	26/2+	20/2	53	16/1+	20/2	16/1+	64	30/3	30/3	20/2	3.52	90
Read: 2	115	3.22	0	20/2	20/2	16/1+	67	15/1	16/1+	15/1	75	26/2+	26/2+	20/2	3.43	45
Read: 1+																2
Speak: 2+																2
Speak: 2	115	3.54	0	26/2+	26/2+	20/2	55	17/1+	19/1+	16/1+	66	30/3	30/3	20/2	3.65	103
Speak: 1+	116	3.29	0	20/2	26/2+	16/1+	63	16/1+	17/1+	15/1	73	26/2+	26/2+	20/2	3.49	84
Speak: 1																4

As discussed in Chapter III.E, a survival analysis captures the time-to-event in longitudinal data. We established the terminal event, or the first time the event occurs, to be when a linguist's proficiency drops to 1+ or below in listening and reading. We set this threshold because it is the first half-step proficiency level below DLI graduation standards for listening and reading. We could not conduct a survival analysis for speaking since there were not enough data points in either the small or large dataset. Linguists who graduated with a 1+ or less were not included in the analysis since we considered that the terminal event occurred at graduation. Once linguists triggered the terminal event, meaning their proficiency fell to 1+ or below, they were removed from the analysis, even if their proficiency level returned during the next proficiency test. If a linguist was removed from one skill survival analysis because a terminal event occurred, he or she could still be a part of the other skill survival analysis as long as he or she had not fallen to 1+ or lower in that proficiency.

The listening survival analysis with 95 percent confidence intervals is shown in Figure 11 and depicts a clear difference between each level. The first year following graduation, each proficiency level appears stable or horizontal. This apparent stability is only an artifact of the linguists' testing cycles. Linguists are only required to test annually following DLI graduation, so even if their proficiency skills decay immediately after graduation, the decay will not be observed until the first assessment DLPT after DLI graduation. This horizontal line makes it appear that skill proficiency is stable for at least a year following graduation, when in reality these skills have presumably already started to decay (United States General Accounting Office, 1994). This is one challenge with using the survival analysis with language skills; a proficiency event can occur at any time, but since linguists normally only test once a year, an event may not be captured until almost a year after it happens. The proficiency level decay is evident with the linguists first annual DLPT. Each proficiency level loses linguists to the terminal event, but the loss is the most drastic with lower-proficiency linguists.

The graph depicts there is a 25 percent probability that level 2 linguists will fall to 1+ during the first year. This probability decreases to roughly 10 percent for level 2+ linguists and 5 percent for level 3 linguists. Near the end of the survival analysis

timeline, roughly a 10-year period, the probability of an event has risen to 90 percent for level 2 linguists, 70 percent for level 2+ linguists, and 50 percent for level 3 linguists.

Figure 12 shows similar results with the reading proficiency survival analysis. The decay in reading proficiency probability is slower than for listening. This may be an artifact of the DLPT. Depending on the DLPT version, a linguist is only allowed to listen to the audio passage one or two times and then must answer the question. In reading, a linguist may reread the passage as many times as necessary for better comprehension, time permitting, before answering the question. The ability to reread for better comprehension may be the cause of the differences in the probabilities between the two skills.

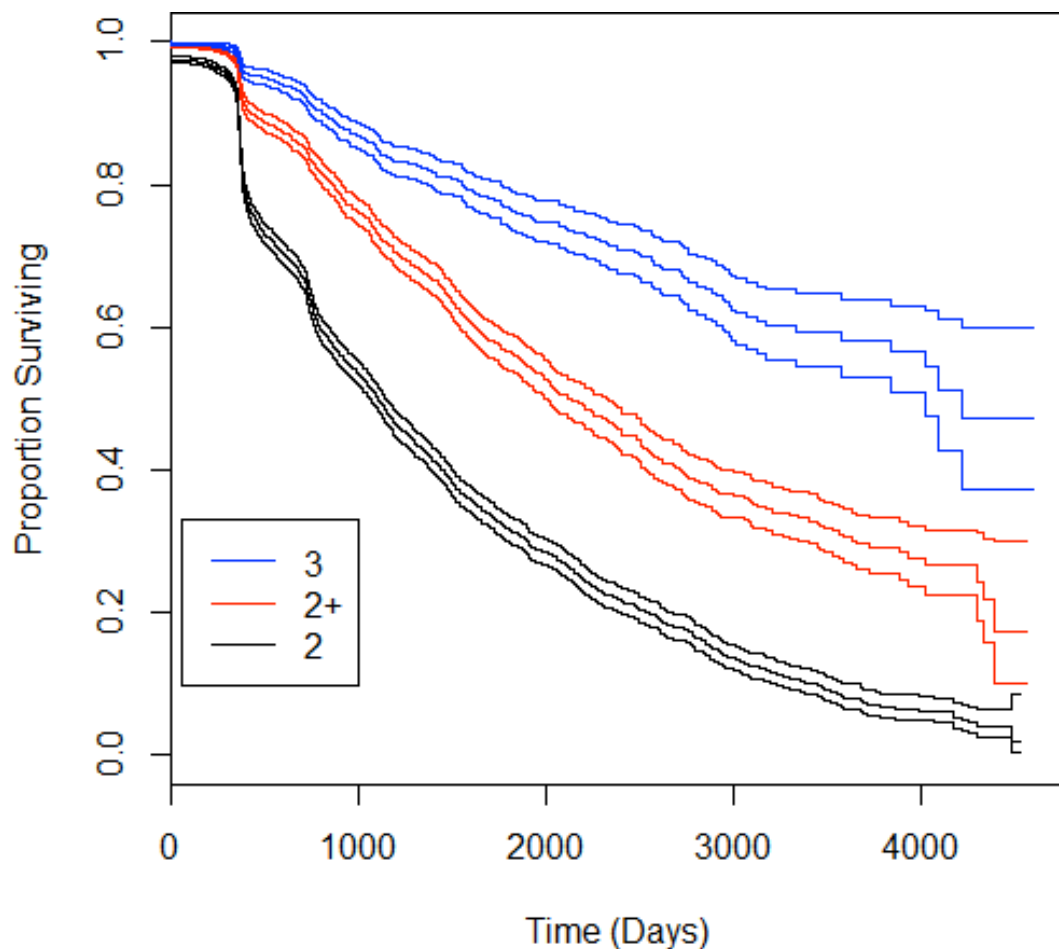


Figure 11. Survival Until 1+ or Less by Basic Course Listening Proficiency Level with 95% Confidence Intervals

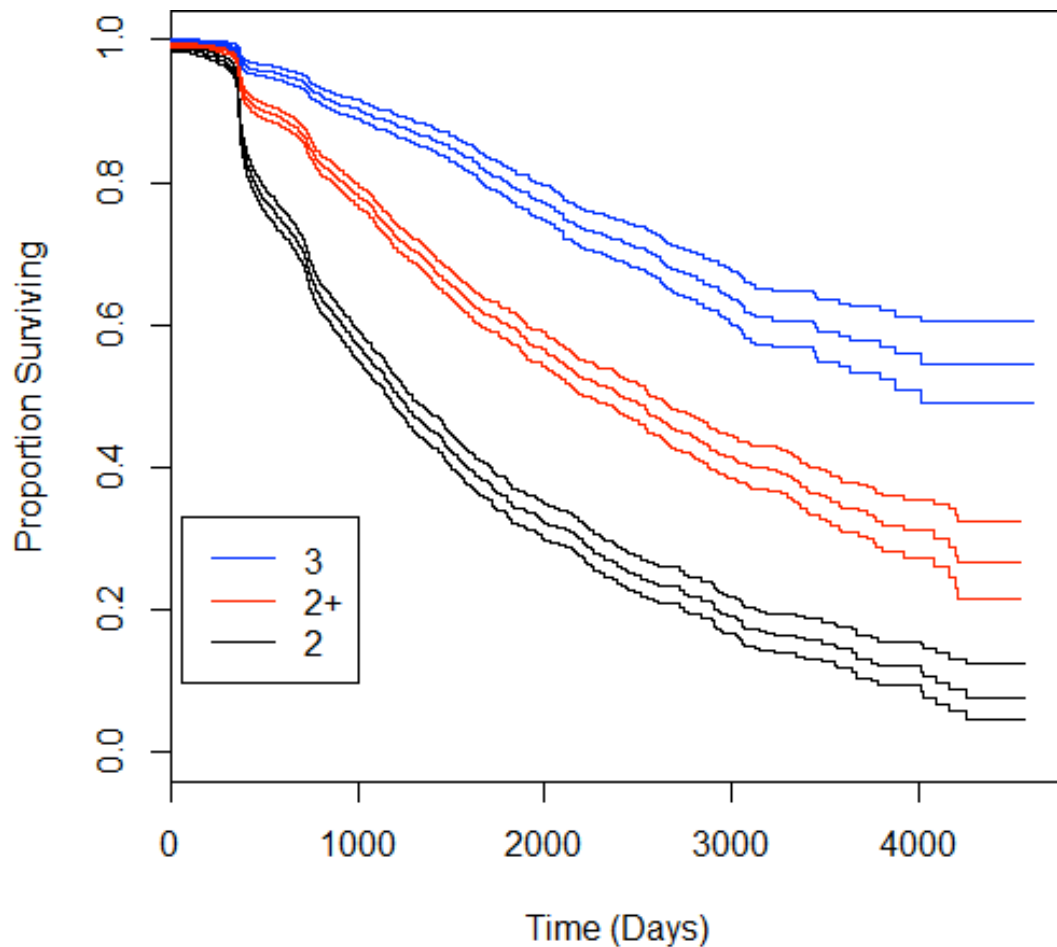


Figure 12. Survival Until 1+ or Less by Basic Course Reading Proficiency Level with 95' Confidence Intervals

Figures 11 and 12 demonstrate that higher proficiency linguists clearly maintain their proficiency for a much longer period of time than lower-level linguists and that the rate of proficiency decay is lower. These results support the hypotheses that proficiency level is strongly associated with L2 change.

In 2015, DLI will change the graduation requirements for the basic course to 2+/2+/2. We conducted a survival analysis to see what would happen to the survival curve once these new requirements are in place. We anticipated that the curve would be steeper. It includes only two groups since linguists who graduate at level 2 are not included in the analysis. The listening survival analysis is shown in Figure 13 and reading is shown in Figure 14.

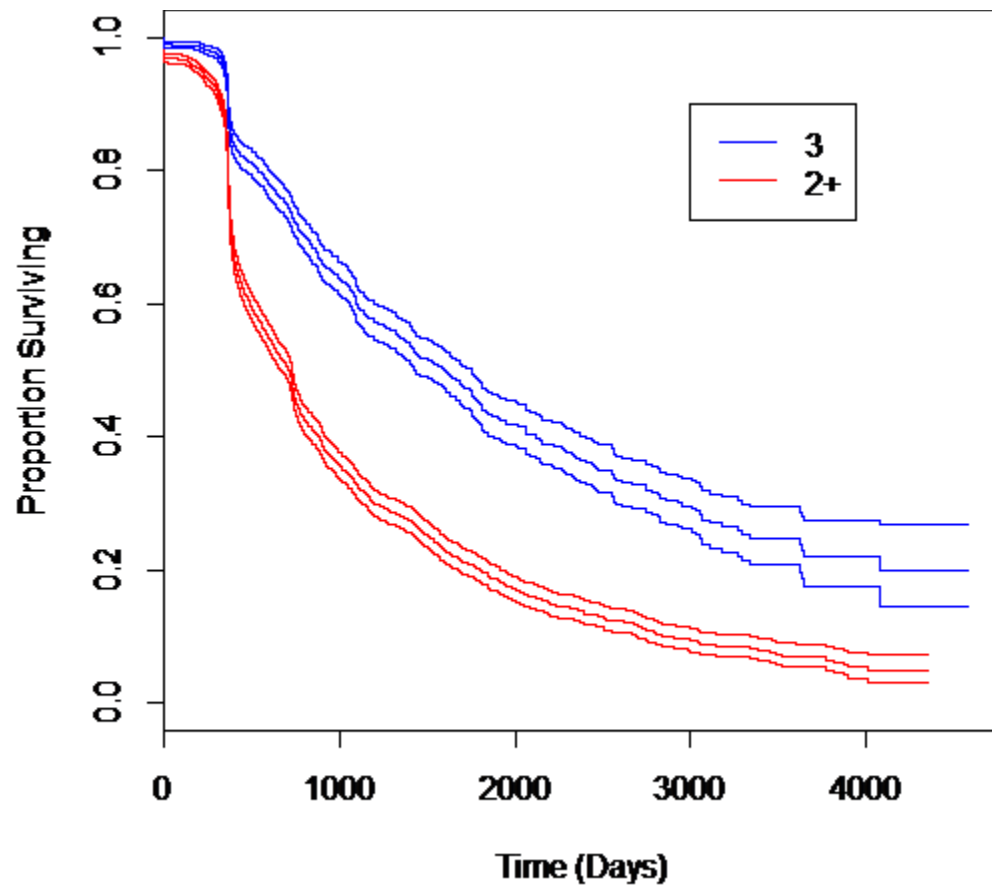


Figure 13. Survival Until 2 or Less by Basic Course Listening Proficiency Level with 95' Confidence Intervals

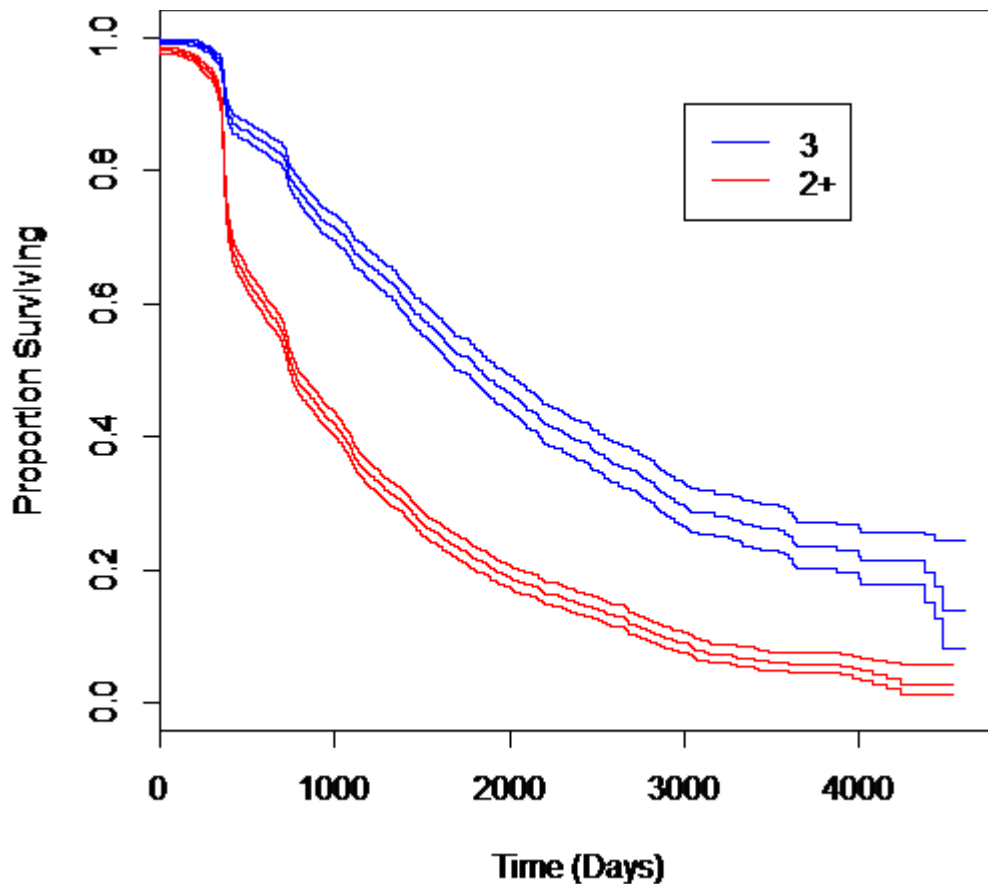


Figure 14. Survival Until 2 or Less by Basic Course Reading Proficiency Level with 95' Confidence Intervals

The survival curve is much steeper in both charts, with the curve for listening being a bit steeper than the curve for reading. There is still a clear difference between each level. We also ran this same analysis by language to see what effect it would have, and the results for listening and reading are shown in Figures 15 and 16, respectively. The probability that a linguist will not attain the listening proficiency requirements for graduation is roughly 50 percent. The graphs for reading are a bit higher, but there is still a large group of linguists who will not make the proficiency standards for graduation.

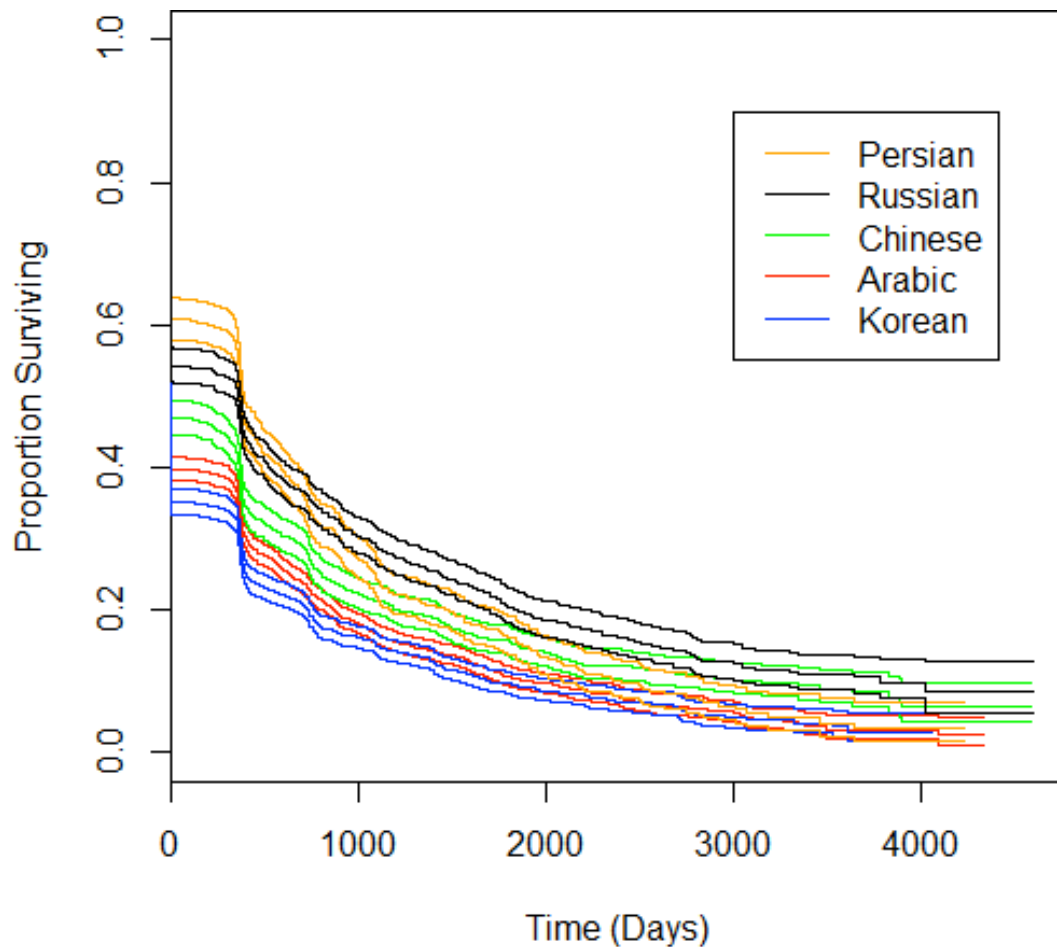


Figure 15. Listening Proficiency Survival Until 2 or Less by Language with 95' Confidence Intervals

The results from Figures 13 thru 16 demonstrate that one major impact increasing the required proficiency scores will have is to reduce the number of qualified DLI graduates by nearly 50 percent. This substantial decrease in qualified DLI graduates may negatively impact military operations. If operational units require assigned linguists to maintain DLI graduation standards in order to be qualified then refresher training, whether conducted via in-residence, through distance learning, or with on-site language teams must be seriously considered. It may also be necessary for DLI to extend the basic-course training period to increase graduation scores to meet the proficiency requirements. The implications will be even greater if DLI increases the graduation requirements to 3/3/2+ (Association of the United States Army, 2010).

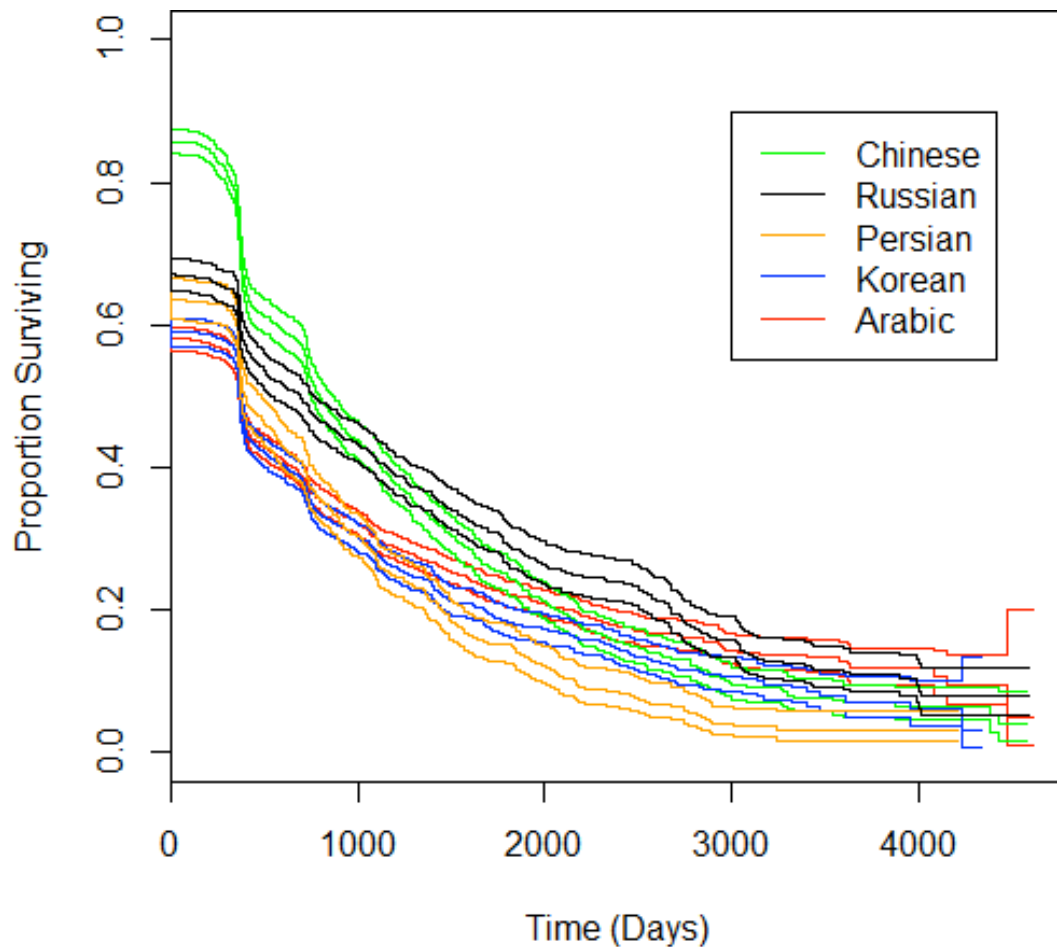


Figure 16. Reading Proficiency Survival Until 2 or Less by Language with 95% Confidence Intervals

2. Incubation Period Length

This section's purpose is to discuss how the incubation period affects L2 change. Incubation period length has been hypothesized to have a direct influence on the amount of L2 skill change experienced by linguists; the longer the incubation period, the more language decay should be observed. One of the constraints of the incubation period was no L2 use or pressure to use the L2; however, many of the military linguists in this research were required by to use their L2 skills in varying degrees. This made the data noisier and potentially masked subtle patterns of L2 change.

Box plots were used to compare L2 listening, reading, and speaking skill change over three incubation period gaps: short (1-42 months), medium (43-64 months), and

long (>64 months). The results in Figure 17 were not expected. The short and medium gaps show an increase of skill loss with time, but the long gap showed an increase in proficiency. A scatterplot by language category, Figure 18, revealed that category III languages followed the expected trend of greater skill loss over time but category IV languages did not.

One explanation for category IV's positive trend line is the mass of linguists who returned for additional training between the three and seven year point. Their L2 change, as depicted in Figure 19, looks like a shotgun blast, with no clear trend of increasing or decreasing proficiency. One or two influential outliers could be the cause of the fit line's positive slope. In an effort to understand why category IV was different, subsets of linguists from the scatterplot were analyzed for differences.

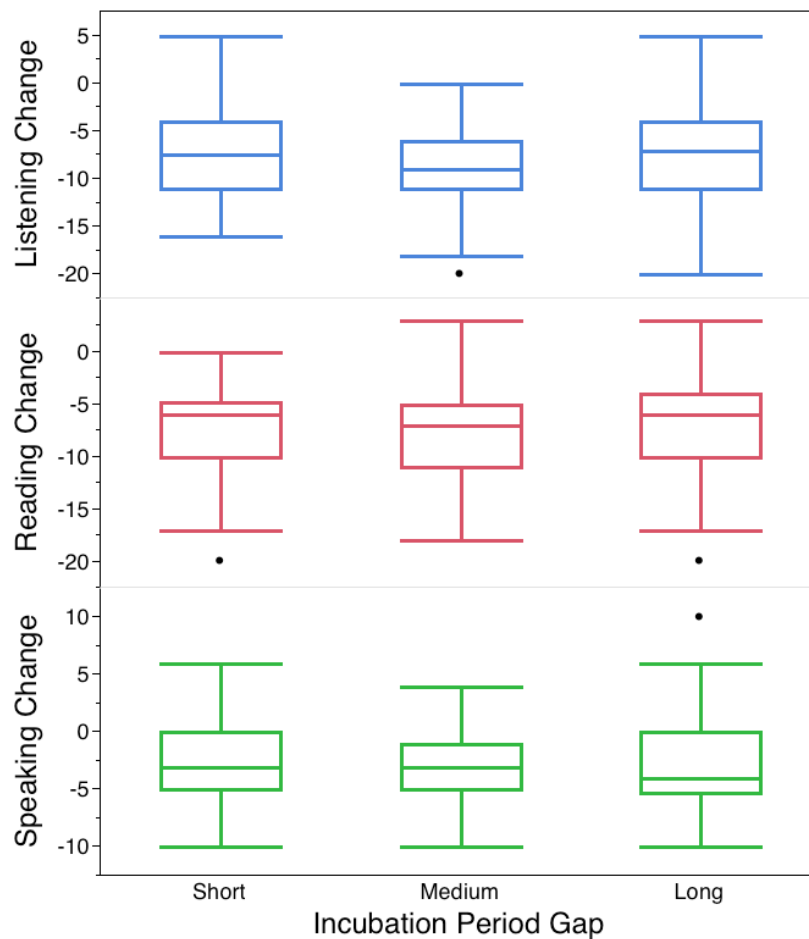


Figure 17. Skill Change by Incubation Period Gaps

Category IV linguists who did not lose, or even gained, skill were grouped together; likewise, the same was done for linguists who lost one and a half steps, 15 points or more. The speaking skill grouping criteria were a little different; linguists who lost more than a half a step, six points, were put together. Table 12 displays the groups' characteristics. The only real notable difference is the groups that kept or gained proficiency graduated the BC with lower proficiency levels than the other group, except for speaking. Both groups contained linguists who attended additional L2 courses at DLI. Removing these linguists did not change the fit line's observed positive slope in the scatterplot of category IV languages. The association between L2 change and the incubation period using the small dataset were inconclusive.

Since the incubation period results were inconclusive, we decided to use the large dataset to determine if the length of time since graduation was associated with L2 skill change. The results of the survival analyses from the last section lend support to the hypothesis that there is a relationship between the incubation period's length and the amount of L2 change. The probability that a linguist will fall to 1+ or lower in skill proficiency increases as the length of time since graduation increases for all three proficiency groups. This result provides additional support for the skill retention theory.

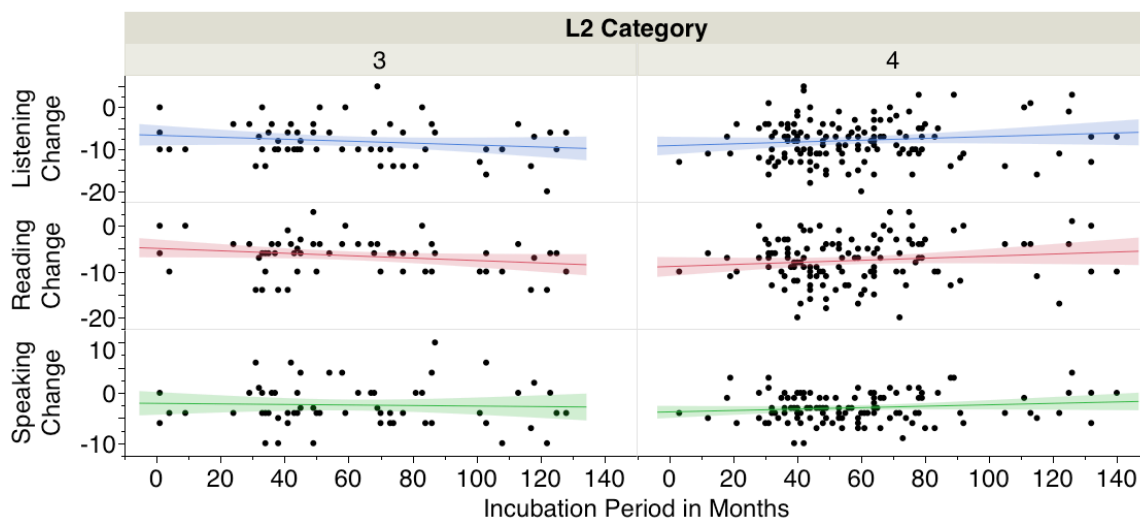


Figure 18. Proficiency Change in Small Dataset by Incubation Period Length and Language Category

Table 12. Group Characteristics of Category 4 Languages

Skill	L2 Change	Size (n)	Basic Course Score	Number in Group Who Attended a Follow-on Course
Listening	Even or gained	10	16-20 (1 at 26)	3
Listening	Lost	11	26-30	2
Reading	Even or gained	10	16-20 (2 at 26)	3
Reading	Lost	10	26-30	2
Speaking	Even or gained	26	16-20 (1 at 10)	1
Speaking	Lost	20	16-20 (1 at 26)	1

3. Basic Course GPA

The goal of this section is to demonstrate the relationship between a linguist's GPA and L2 change. An interesting pattern emerged from the group data in Table 11, an excerpt of which is shown in Table 13. It was observed that the GPA increased with higher proficiency levels.

Table 13. Basic Course Proficiency Level with Associated GPA and Number of Linguist Represented in the Small Dataset

Skill:Level	BC GPA	N
Listen: 3	3.62	43
Listen: 2+	3.52	71
Listen: 2	3.26	69
Listen: 1+	N/A	10
Read: 3	3.58	56
Read: 2+	3.45	90
Read: 2	3.22	45
Read: 1+	N/A	2
Speak: 2+	N/A	2
Speak: 2	3.54	103
Speak: 1+	3.29	84
S: 1	N/A	4

A similar trend was also observed for the post-graduate course GPA, except for listening levels 3 and 2. The follow-on course GPA was not used in the analysis since it was taken after the incubation period and cannot be used as an indicator of L2 change following the basic course. It may be useful in future studies to research L2 change after follow-on courses.

We used the Cox Regression Analysis to determine if there was an association between the basic course GPA and listening L2 decay, Figure 19, and reading L2 decay, Figure 20. The resulting graphs demonstrate that there is a difference between GPA levels; students with a higher GPA have a higher probability of maintaining their proficiency for a longer period of time than those linguists in the same language but with a lower GPA.

These results support prior DLI research that the basic course GPA is an indicator of a linguist's performance on the basic course DLPT and OPI. It also appears that the basic course GPA may be associated with L2 change during the incubation period, as well as with a linguist's success at reacquiring baseline proficiency during a follow-on course.

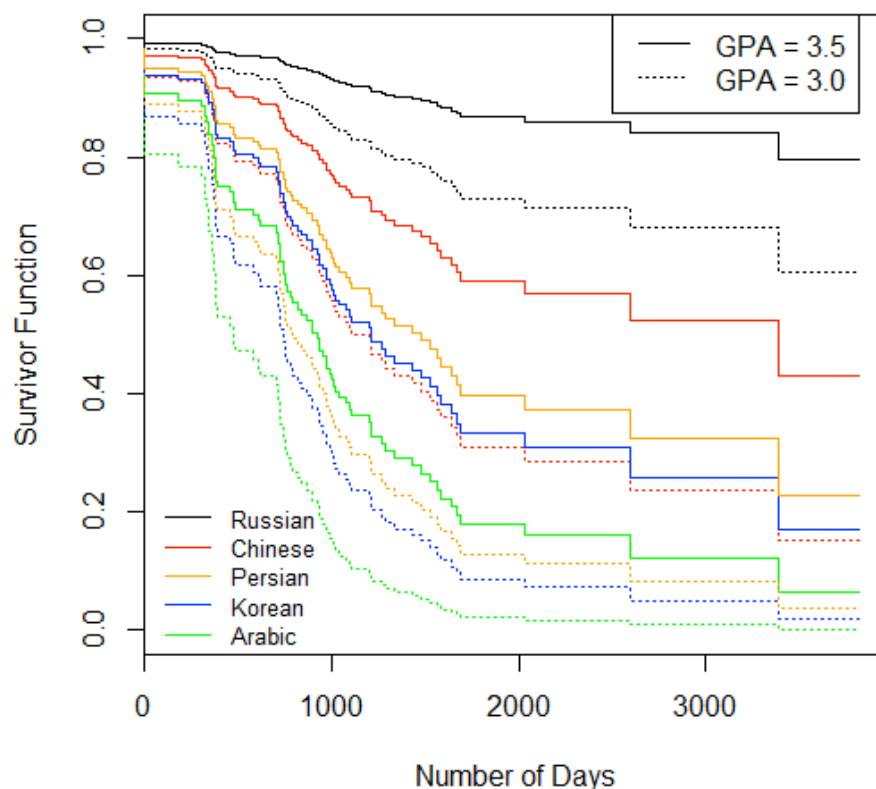


Figure 19. Cox Model for Listening Proficiency Survival to 1+ or Less, by Language and GPA

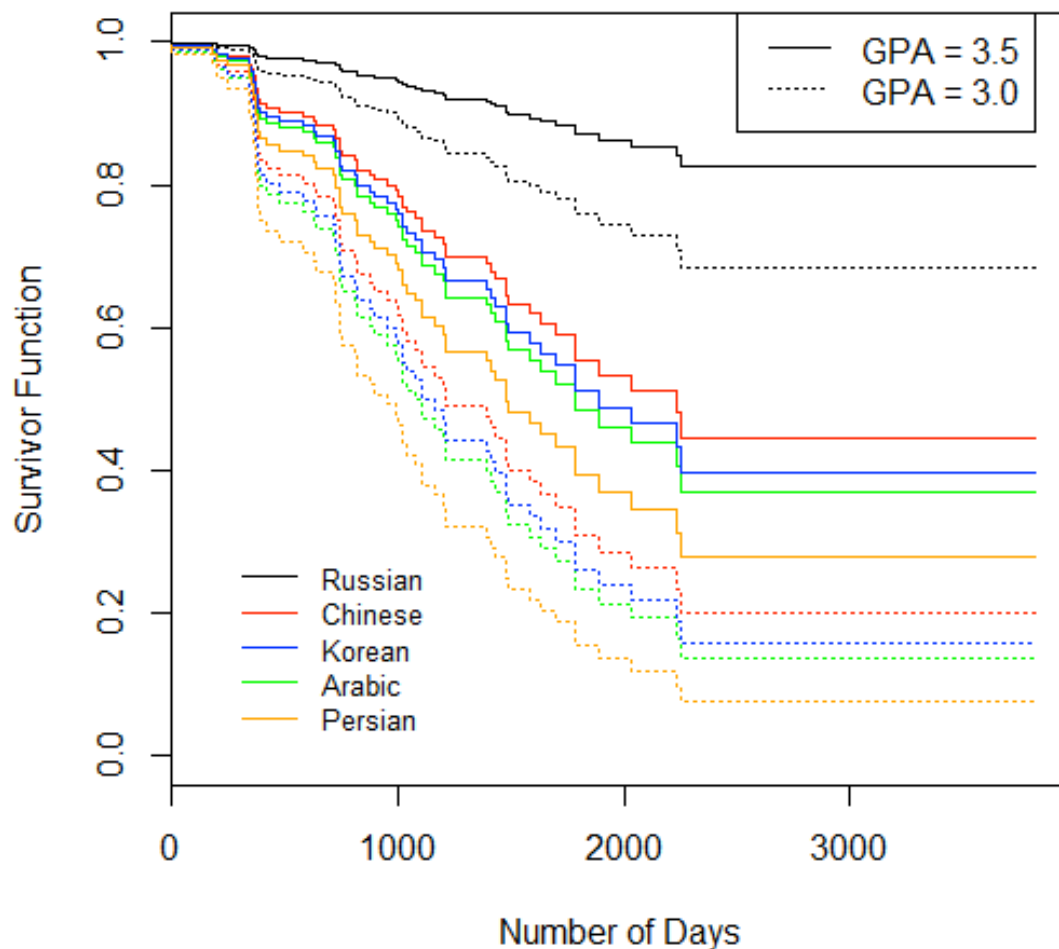


Figure 20. Cox Model for Reading Proficiency Survival to 1+ or Less, by Language and GPA

4. Gender

This study adds support to other studies that have found that gender does not have a strong association with L2 change (Ehrman, 1996). There was no statistical difference between male or female linguists in language decay or reacquisition.

5. DLAB Scores

DLAB scores are meant to indicate if someone has the aptitude to learn an L2 and is used as a tool to determine what category of language a linguist might be able to learn. In order to take one of the more difficult languages at DLI, a linguist must have high DLAB scores. By placing linguists in classes in this manner, the higher category

languages are weighted with higher DLAB scoring linguists. Despite this weighting, the DLAB does not appear to be associated with L2 change.

6. Additional L2 Training

The purpose of this section is to describe the effect of additional, or follow-on, L2 training in L2 change. Some linguists in the large dataset were given follow-on L2 training opportunities in the same L2 as their first basic course. We wanted to know if these additional courses helped linguists maintain their proficiency skills longer than those who only attended the basic course.

One criterion we established to evaluate the dataset was that a linguist could only have one basic course on record; if linguists had two basic courses, their records were removed from the analysis. This ensured that the original basic course L2 was analyzed. We also filtered out linguists who had returned a third or fourth time to DLI for the same language, since the number of linguists with that circumstance was small, as shown in Table 14.

After applying these rules to the large dataset, we tracked those linguists who did not participate in a second course until their listening and/or reading proficiency fell to a 1+ or lower and then removed them from the analysis. We did the same for the second course linguists, but tracked only the listening and reading scores that were recorded following the second course. We did this because some of these linguists' proficiency may have fallen to 1+ or lower prior to returning to the second course. We only wanted to know what happened to their proficiency retention following the second course.

Table 14. Numbers of Basic Course Linguists Returning for Follow-on L2 Training in Original L2

Basic Course	Second Course	Third Course	Fourth Course
15,503	1,928	94	12

Figure 21 shows the results for listening and Figure 22 shows the results for reading. The results were not what the skill retention theory or intuition would suggest. Linguists who return for follow-on training are expected to reacquire decayed skills and learn new skills, which would help them to retain L2 proficiency longer. The analysis

showed that second-course linguists were losing language proficiency faster than one-course linguists. (The vertical lines at the end of the curves are artifacts from last linguist finally dropping to the terminal event.) In order to understand why the results were contrary to what we expected, the linguists who attended follow-on training were grouped into cohorts based on the type of training they attended. Figure 23 shows the number of linguists who attended the different follow-on courses. Figures 24 and 25 show the results for listening and reading respectively.

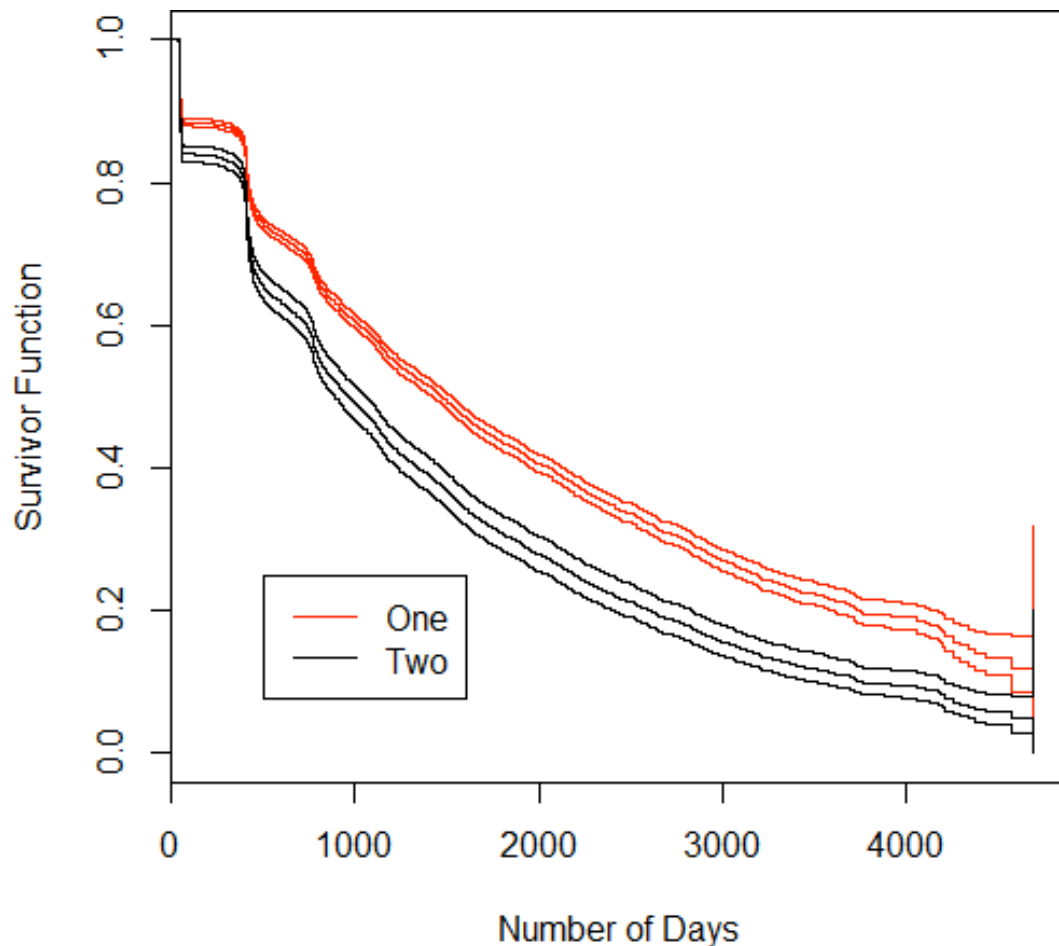


Figure 21. Cox Model for Listening Proficiency Survival to 1+ Less by Number of Courses Completed, Excluding Guard and Reserves, with 95% Confidence Intervals

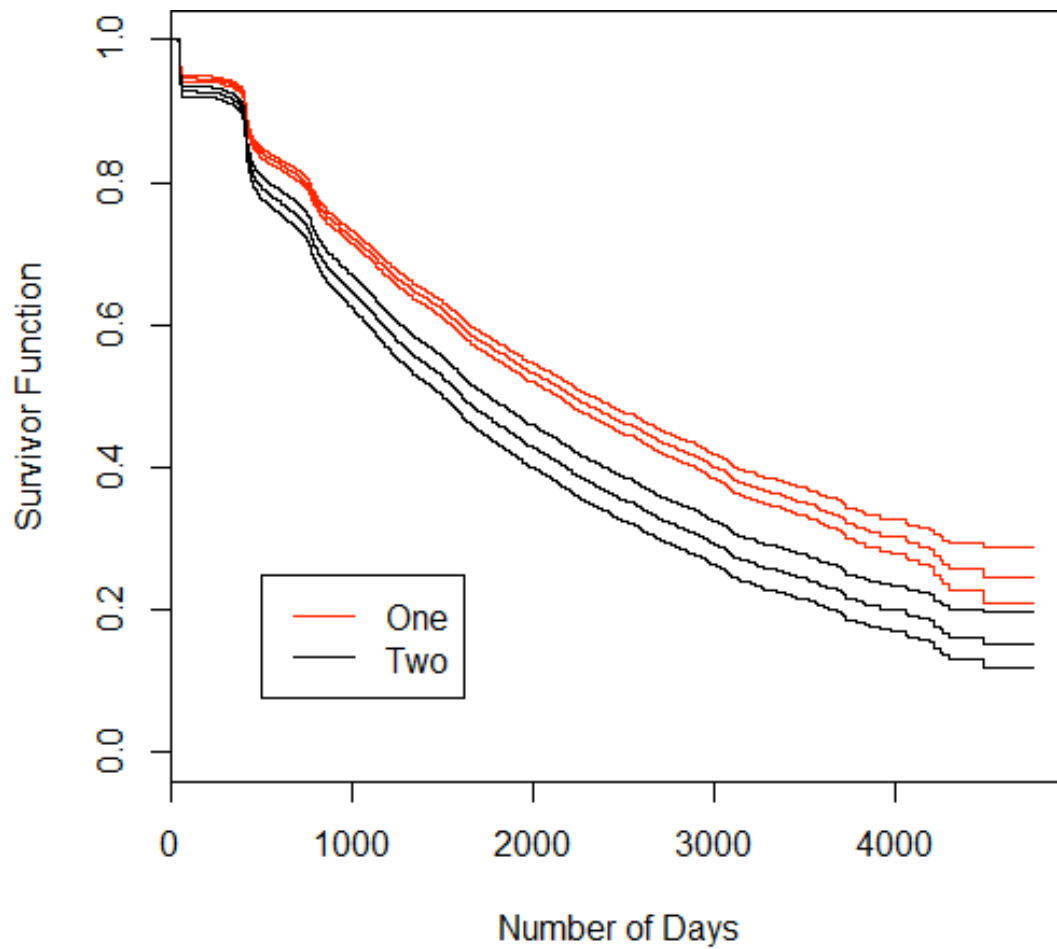


Figure 22. Cox Model for Reading Proficiency Survival to 1+ or less by Number of Courses Completed, Excluding Guard and Reserves, with 95% Confidence Intervals

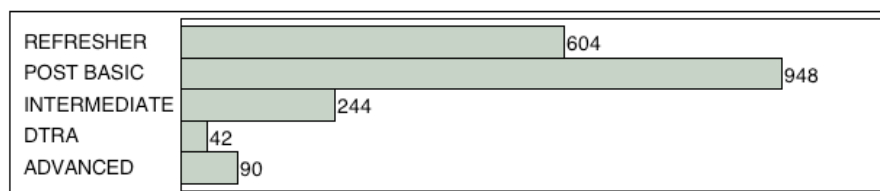


Figure 23. Number of Linguists in Each Cohort Group Based on Follow-on Course

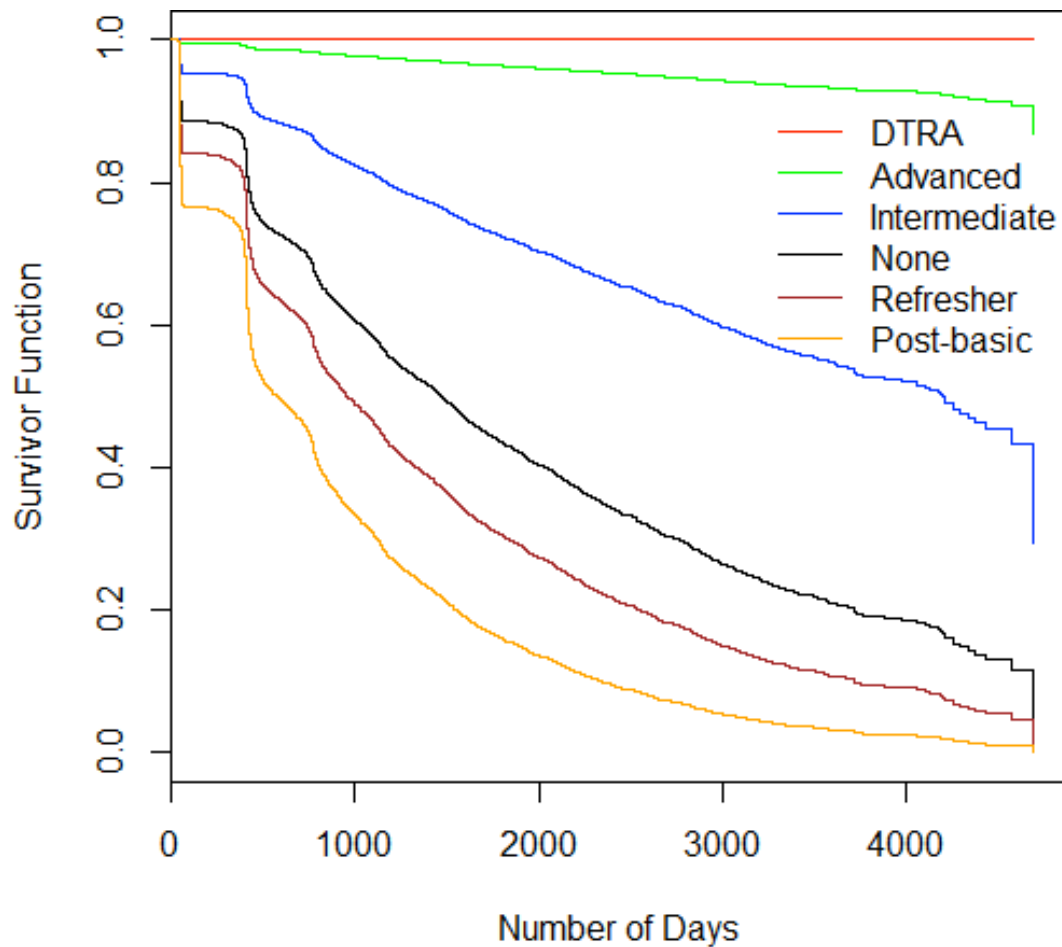


Figure 24. Cox Model for Listening Proficiency Survival to 1+ or Less by Type of Follow-on Course Completed, Excluding Guard and Reserves

Two results from the listening and reading Cox models stand out. First, not one DTRA linguist experienced a terminal event during the entire 13+ years of these data. These linguists have reached a proficiency level that appears to be immune from decay, as the skill retention theory suggests will happen in the third stage of learning. The advanced course linguists' curve is also significantly different from the other courses and does not appear too different from the DTRA linguists. This prompted the question, what is the difference between these the DTRA and advanced linguist cohorts? The graduation results from the two cohorts were compared against each other to see if this question could be answered, and the results are found in Table 15. There is no difference between the two cohorts in listening and reading skill proficiency, but there is a half-step difference in speaking. The DTRA course stresses speaking, translating, and interpreting

(Defense Language Institute, 2011). It appears that this half step in speaking proficiency is the only difference that can explain why DTRA linguists never fall to a terminal event. Building up a linguist's speaking proficiency may be what reduces the likelihood of proficiency decay for higher proficiency linguists.

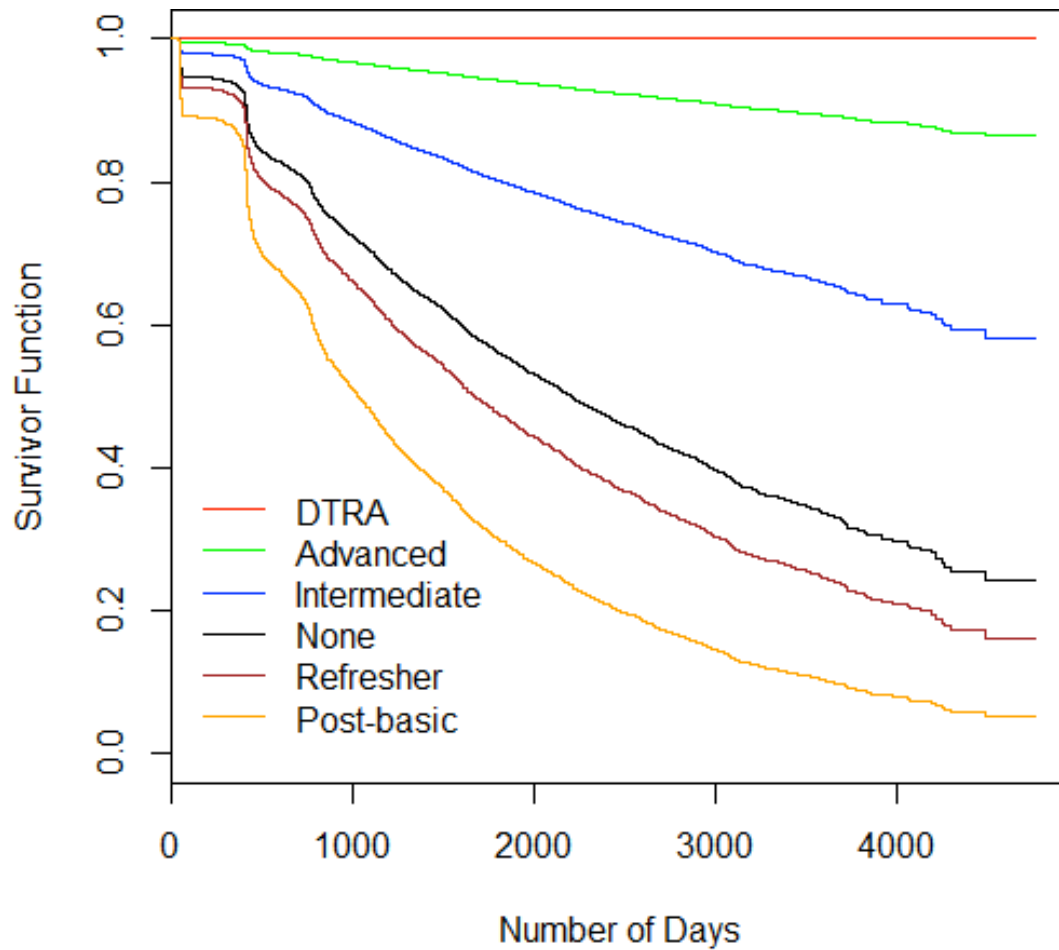


Figure 25. Cox Model for Reading Proficiency Survival to 1+ or Less by Type of Follow-on Course Completed, Excluding Guard and Reserves

Table 15. DTRA and Advanced Cohort Proficiency Score Comparison

Cohort	Listening Score	Reading Score	Speaking Score
DTRA	2+ to 3	2+ to 3	2+
Advanced	2+ to 3	2+ to 3	2

Listening and reading are both receptive skills and are easier to learn than the productive skills of speaking and writing. When a linguist is more proficient at using productive skills, these productive skills may strengthen the receptive skills against decay. Military linguists' speaking proficiency is not tested annually, so there may be fewer efforts made to maintain this skill. Decay in speaking proficiency may also have a negative effect on listening and reading proficiency.

The survival curve for the refresher and post-basic courses in Figures 25 and 26 also stand out in comparison to the one-course curve. The refresher and post-basic cohorts have a significantly faster decay rates. This result is not too unexpected for the refresher course since the purpose of this course is to restore proficiency that was lost, not add new skills. The stated refresher course goal is to add a half step to the linguists' current proficiency (Defense Language Institute, 2011), which may be below DLI graduation requirements and the linguists' baseline score. These linguists may have already experienced L2 decay and four months of refresher training may not restore their prior proficiency.

The post-basic survival curves in Figures 25 and 26 were unexpected. These linguists did not meet the minimum proficiency criteria for graduation and were enrolled in a post-basic course to bring their skill(s) up to the minimum requirements. Post-basic courses usually start within a few weeks of basic course completion, so skill decay should be minimal compared to those linguists returning for a refresher course. The fact that even an additional four months of training does not produce a survival curve similar to the one-course linguists is surprising and may give DLI reason to review the effectiveness of this course, especially with the current economic constraints the DoD is facing.

Additional training can be a significant factor in L2 proficiency retention, but retention depends on the follow-on course. Intermediate, advanced, and DTRA classes are designed to build upon prior skills and increase the proficiency of linguists, whereas the refresher is meant to improve current proficiency by a half step and the post basic course is to help unqualified DLI graduates attain the minimum proficiency required for

graduation. Linguists who participate in intermediate, advanced, and DTRA classes retain their skills much longer than linguists who do not return for follow-on training.

7. Language and Language Category

This section's purpose is to discuss how different languages and language categories influence L2 change. The small dataset of 193 linguists was not useful for this analysis since the sample size was not large enough. For instance, the small dataset seemed to indicate that Korean linguists lost the most proficiency during the incubation period; however, these linguists also had the lowest basic course scores. Additionally, there were only nine Persian-Farsi linguists, so the L2 change among this group of linguists was unreliable. In order to get a better idea of language and language category relationships with L2 skill change, we used the large dataset of 16,000 linguists to do a survival analysis.

The first survival analysis of listening proficiency by time and by language as shown in Figure 26, depicts a clear difference between Russian and the other languages. An interesting note is that Persian-Farsi and Russian, which are both category III languages, start out together with Chinese, a category IV language. Within a year, the Chinese survival curve separates itself from Russian and Persian-Farsi and begins to move towards the other category IV languages. Around day 1200, or just over three years, the Persian-Farsi survival curve separates from Russian and begins to behave more like a category IV language. By day 2000 all languages except for Russian are grouped together until the end of the period.

Russian is clearly distinguished from the other languages in the reading survival analysis as depicted in Figure 27. Persian-Farsi's reading survival curve, unlike as in listening, starts at the bottom of the group and remains there throughout the analysis. Perhaps the low survival rate of Persian-Farsi linguists, as depicted in these graphs, is one reason why there is a movement to change it to a category IV language. Around day 2000, the bottom four languages begin to separate themselves, unlike in listening where they clumped together, with Russian maintaining the best survival curve.

With only five languages available to analyze and Persian-Farsi's survival curve behaving more like a category IV language, it is difficult to tell if language category plays a role in L2 change. Russian, the only other category III language, is clearly distinguishable from the other languages in both analyses, hinting that language may play a role. In order to determine if language and language categories are associated with L2 change, more languages from each language category are needed to conduct new survival analyses. While the current results are inconclusive, they hint that language category may play a role in L2 change. Using more languages from all 4 categories may show that linguists in lower language categories retain their language proficiency longer than higher category languages.

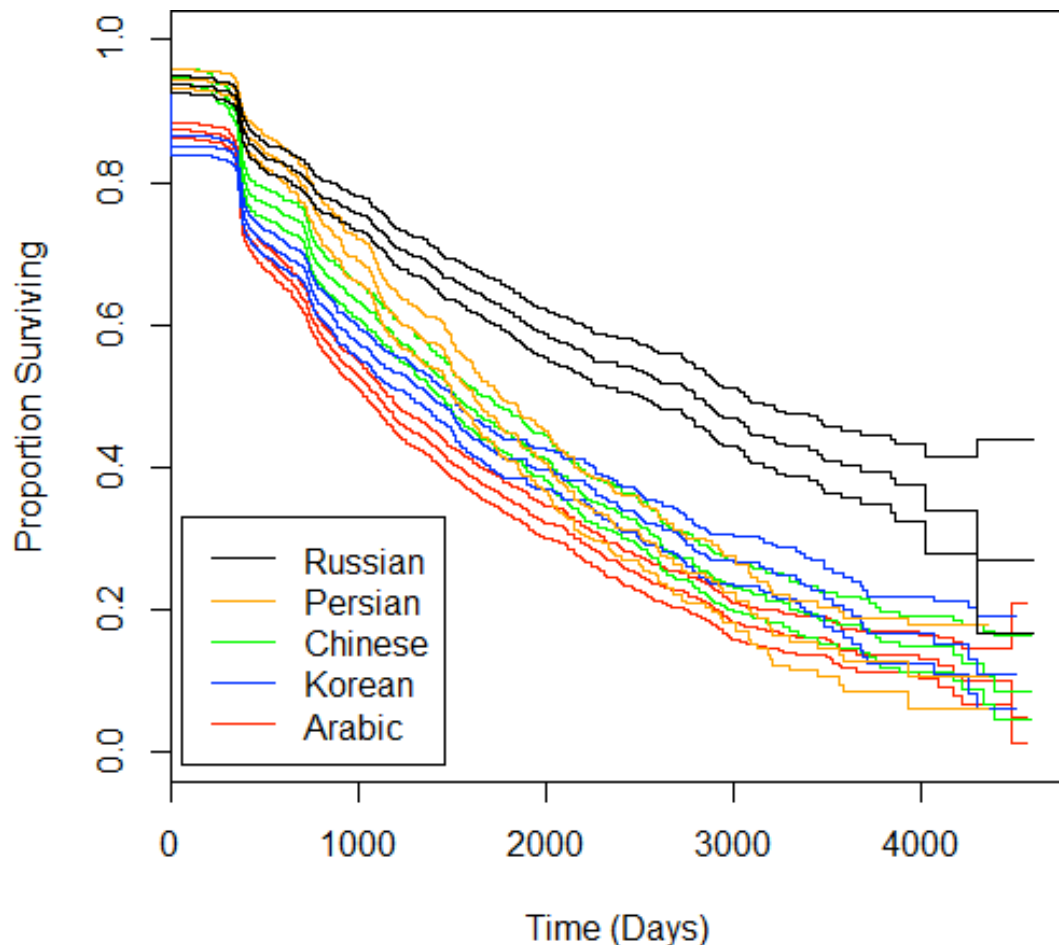


Figure 26. Survival Until 1+ or Less by Listening Proficiency Level by Language with 95% Confidence Intervals

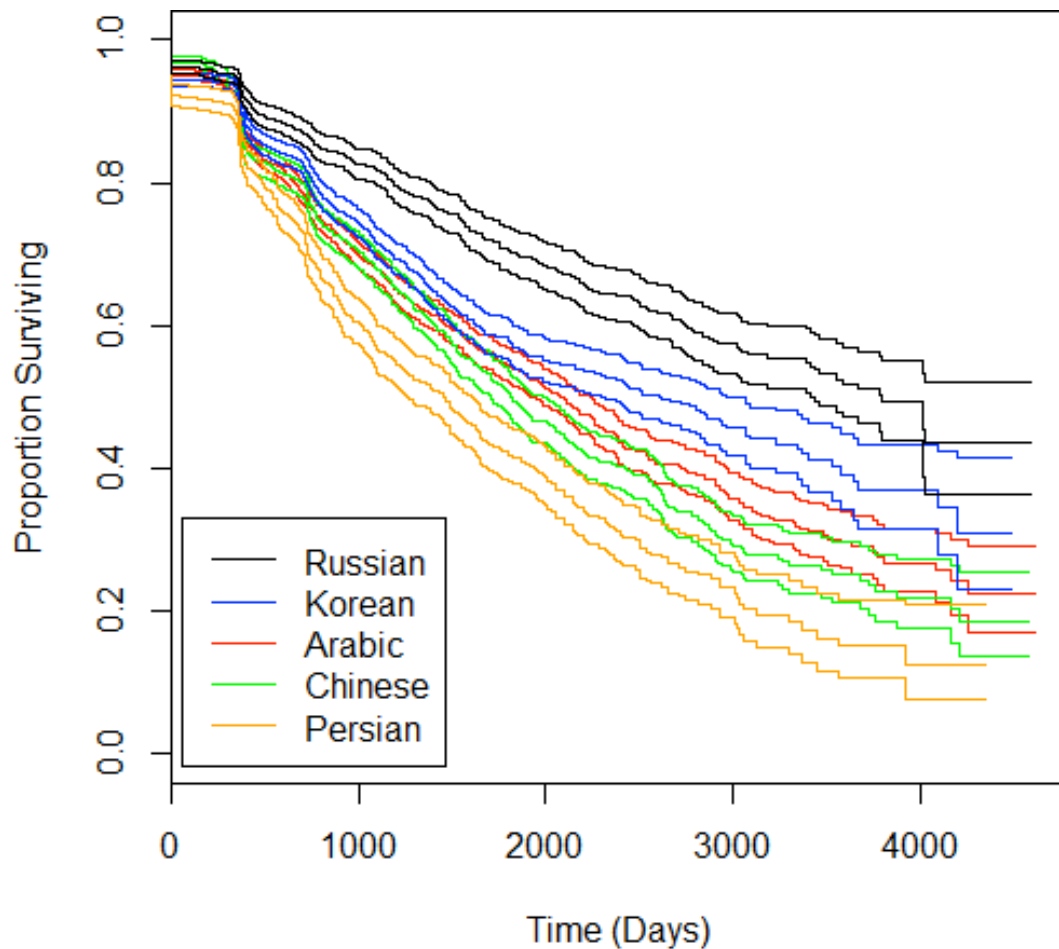


Figure 27. Survival Until 1+ or Less by Reading Proficiency Level by Language with 95% Confidence Intervals

C. REACQUISITION OF DECAYED PROFICIENCY

According to the skill retention theory and savings effect, reacquisition of decayed knowledge or skill should take place at an expedited rate since the knowledge has not been forgotten, but the ability to recall the knowledge has deteriorated. The majority of the linguists in the small dataset experienced L2 proficiency decay following graduation from the DLI basic course. The reacquisition of decayed proficiency was captured by the DAs administered during the follow-on course, as depicted in Table 16 (refresher courses do not conduct the midterm DA).

Table 16. Progress of the 193 Linguists in Small Dataset in Reacquiring Decayed L2 Proficiencies by Skill Category as Recorded by the Diagnostic Assessment During DLI/CE's Follow-on Courses

Skill Change	1st DA L	2nd DA L	3rd DA L	DLPT L	1st DA R	2nd DA R	3rd DA R	DLPT R	1st DA S	2nd DA S	3rd DA S	DLPT S
Lost	177	89	41	20	178	94	45	24	137	43	17	10
Maintained or Regained Baseline	8	15	33	69	11	17	35	83	30	34	16	93
Exceeded Baseline	8	28	82	104	4	21	76	86	21	54	123	90
Total Linguists Assessed	193	132	156	193	193	132	156	193	188	131	156	193

The first DA is conducted at the beginning of the course. The linguists' current proficiency is captured and the L2 change can be found by comparing the results against their baseline (basic course graduation scores). About midway through the course, a second DA is used to assess the progress of the linguists. Likewise, about four weeks before the end of course DLPT another DA is conducted to ensure the linguists will make the minimum course proficiency levels to graduate. Finally, the DLPT is the last assessment as to whether the linguists have fallen below, met, or exceeded their original baseline scores.

The length of basic course training for category III and IV languages is 48 and 64 weeks respectively, while intermediate and advanced training for category III and IV languages last 36 and 47 weeks respectively (Defense Language Institute, 2011). DTRA, specialized training for Russian linguists, is 47 weeks, and the refresher course duration is four months (Defense Language Institute, 2011). Each follow-on course is shorter in duration than the BC and the majority of linguists who returned to DLI for follow-on or refresher training reacquired their baseline scores by the last DA, and the percentage increased by the official DLPT.

One area in the DA that caused concern was the 3rd, or final, DA in speaking. There were 123 linguists whose speaking scores were higher than their baseline speaking score during the last DA, but this number dropped to 90 with the OPI. We are not sure what caused this drop, but conceivably rating linguists higher than they really were may have caused some linguists not to prepare as they should have and their speaking scores fell.

The following tables give a breakdown of reacquisition rates by each follow-on course: refresher, Table 17, intermediate, Table 18, advanced, Table 19, and DTRA courses, Table 20.

Table 17. Number of Linguists in Refresher Course Who Scored Below
, Reacquired, or Exceeded Their Original L2 Baseline Proficiency

Language (#students)	Skill	Exceeded Baseline	Reacquired Baseline	Below Baseline
Russian (3)	L	2	1	0
	R	1	2	0
	S	1	1	1
Korean (24)	L	4	11	9
	R	12	8	4
	S	2	18	4
Total (27)		22	41	18

Table 18. Number of Linguists in Intermediate Course Who Scored Below,
Reacquired, or Exceeded Their Original L2 Baseline Proficiency

Language (#students)	Skill	Exceeded Baseline	Reacquired Baseline	Below Baseline
Russian (13)	L	4	8	1
	R	3	6	4
	S	7	6	0
Persian-Farsi (9)	L	1	7	1
	R	3	6	0
	S	5	4	0
Korean (26)	L	19	5	2
	R	16	7	3
	S	10	16	0
Chinese (23)	L	17	6	0
	R	6	12	5
	S	7	16	0
Arabic (19)	L	14	4	1
	R	13	4	2
	S	10	7	2
Total (90)		135	114	21

Table 19. Number of Linguists in Advanced Course Who Scored Below, Reacquired, or Exceeded Their Original L2 Baseline Proficiency

Language (#students)	Skill	Exceeded Baseline	Reacquired Baseline	Below Baseline
Russian (7)	L	3	3	1
	R	2	5	0
	S	3	4	0
Korean (6)	L	3	3	0
	R	3	2	1
	S	3	3	0
Chinese (16)	L	11	5	0
	R	6	6	4
	S	4	11	1
Arabic (15)	L	8	6	1
	R	9	6	0
	S	8	5	2
Total (44)		63	59	10

Table 20. Number of Linguists in the DTRA Course Who Scored Below, Reacquired, or Exceeded Their Original L2 Baseline Proficiency

Language (#students)	Skill	Exceeded Baseline	Reacquired Baseline	Below Baseline
Russian (31)	L	7	9	5
	R	11	19	1
	S	29	2	0
Total		57	30	6

The follow-on courses were successful at helping linguists reacquire their baseline proficiency, and in many cases exceed it. The refresher course, while much shorter in length, appears to promote reacquisition of decayed skills; many linguists in this course reacquired their baseline skills in a short period of time. The results from these courses add support for the savings effect and the skill retention theory.

D. STAGES OF LEARNING FROM SKILL RETENTION THEORY

The purpose of this section is to use the previously discussed results to demonstrate why the skill retention theory is a good model of L2 skills. The survival

analysis on L2 proficiency levels clearly demonstrated that higher proficiency linguists retained their L2 skills longer than lower proficiency linguists. These results are in agreement with the skill retention theory that posits that learners who are in the higher stages of learning will retain their knowledge and proficiency longer than the lower stages. Linguists who make it to stage 3 of learning should maintain their language proficiency indefinitely, while those in stage 1 will quickly forget what they have learned. Support for stages 2 and 3 was found during the course of this research, while support for stage 1 was not.

Stage 1: Based on a prior L2 attrition study, students who only achieved a low level of proficiency, or stage 1, were excluded from the study because they experienced almost complete attrition after being away from the classroom for only a short period of time (Clark & Jorden, 1984). The skill retention theory proposes that skills and knowledge in stage 1 are declarative and when these skills are not practiced or used they will rapidly decay until they are unusable (Kim et al., 2011). In Clark and Jorden (1984) demonstrated these results in their study.

We originally thought support for stage 1 would be found among the linguists who completed DLI but did not achieve the minimum scores necessary for graduation. These linguists, like the students found in Clark and Jorden's 1984 study, had not learned the proficiency skills well enough to move into stage 2. Within a short period of time, we expected these 1+ proficiency linguists to have lost almost all their proficiency. This assumption turned out not to be the case.

While reviewing the annual DLPT scores of the 16 linguists in the small dataset who did not attain the minimum proficiency requirements for graduation, we observed that these linguists continued to maintain their original proficiency level and, in some cases, improved their proficiency. A survival analysis on just those linguists who scored a 1+ on either the listening or reading portion of the DLPT was conducted to see how long they maintained their proficiency. We also included 1+ linguists who were sent back for follow-on training to see if this additional training would improve their probability of maintaining their proficiency. The terminal event was established to be when a linguist's proficiency fell to 1 or less. If these linguists were truly in stage 1 of the skill retention theory, their survival curves should have a very steep slope; however this is not what the listening or reading analyses revealed, as shown in Figures 28 and 29, respectively.

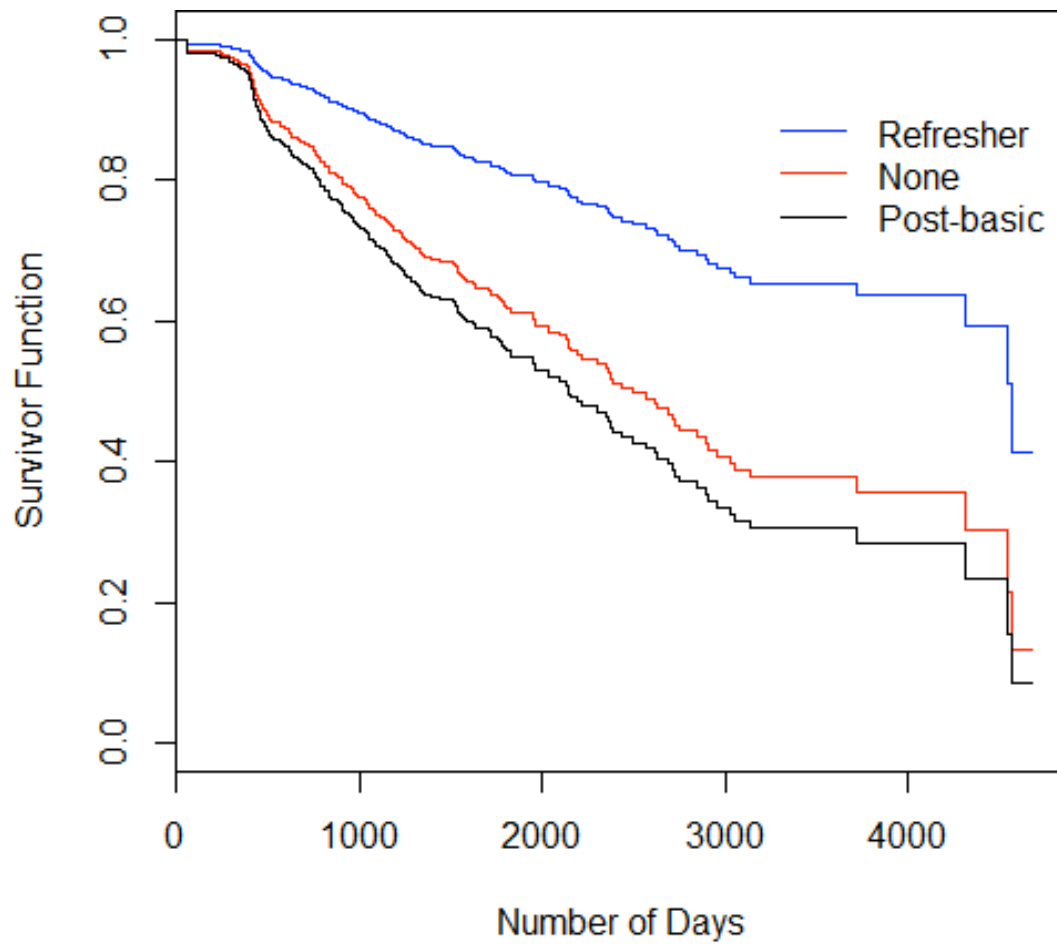


Figure 28. Survival Until 1 or Less by Listening Proficiency Level 1+ by Follow-on Course Completed, with 95' Confidence Intervals

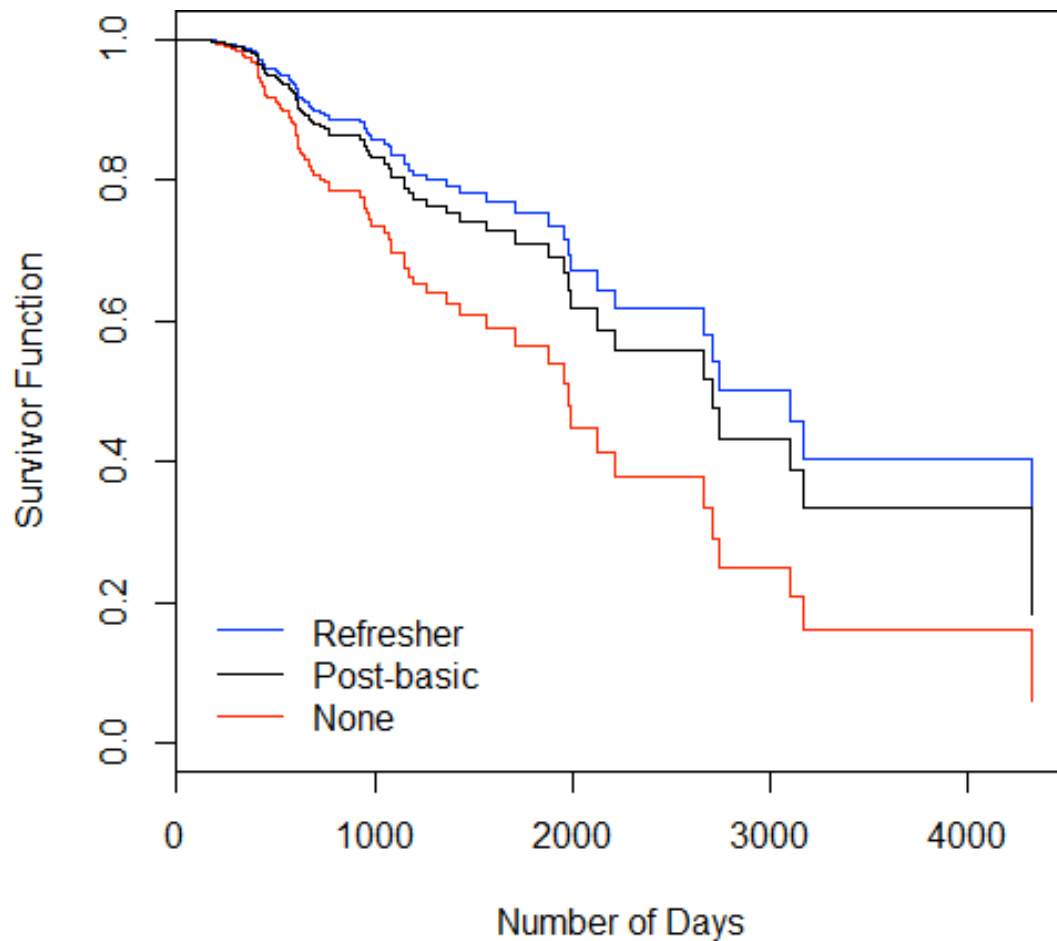


Figure 29. Survival Until 1 or Less by Reading Proficiency Level 1+ by Follow-on Course Completed, with 95' Confidence Intervals

It is evident that these linguists maintained their skills much longer than someone in stage 1 of the skill retention theory. These linguists learned an L2 in an intensive course for a year to a year and a half, during which time some of the basic proficiency skills may have been proceduralized, making their low-level proficiency immune to rapid decay. In order to find support for stage 1 among DLI students, we would have to find linguists who were disenrolled from DLI early in the course and test them for proficiency retention. For now, support for stage 1 comes from Clark and Jorden's 1984 study. During this study, low-level proficiency linguists were excluded because their L2 decay was almost complete after only after a short period of time away from the classroom.

Stage 2: It was hypothesized that most DLI linguists graduate in stage 2 of the skill retention theory, and the results of this dissertation research support this hypothesis.

The skill retention theory states that a linguist's skills and proficiencies at stage 2 are a mix of declarative and procedural knowledge. Over time, the declarative knowledge will decay and the skills and proficiency of the linguists will decrease. The majority of DLI graduates exhibited this behavior, as depicted in many of the survival analyses, with higher-performing linguists lasting longer than lower-level linguists. The skill retention theory also posited that when students return for additional training, their skills and proficiency rapidly return. This was demonstrated by tracking the reacquisition of the 193 linguists who returned for additional training.

Stage 3: The Cox Model using the various follow-on courses as shown in Figures 24 and 25, lends support to stage 3 of the skill retention theory. The DTRA linguists did not experience a single 1+ event over a 10-year period of time. The advanced linguists maintained their high-level proficiency for a long period as well, with the probability of a linguist in this cohort falling to a 1+ or lower being only 10 percent after 10 years. The intermediate linguists also fared well with roughly a 40 percent probability of dropping to a 1+ or lower by the 10th year.

These results model the elements of the skill retention theory. When linguists attain a high-level proficiency, their L2 skills generally became immune to decay, in a way similar to the typing example given in Chapter II.C. The passage of time may make the skills rusty when they are not being used, but those skills will rapidly return when the linguist is put in an environment where those skills are needed, similar to the “Boulogne Ferry Effect” or the “Din in the Head,” described by anecdotal experiences in Chapter II.A.6.a. Those in DTRA, and many of the advanced linguists, reached a proficiency level where their skills were immune from decay for extended periods of time. A substantial speaking proficiency difference exists between DTRA, advanced, intermediate, and refresher course linguists. Perhaps higher speaking proficiency is a significant factor in maintaining listening and reading proficiency, but this is difficult to ascertain since speaking proficiency is not adjudicated annually like listening and reading.

E. PROFICIENCY LEVEL FOR RETENTION

Based on the results of the analysis of the large and small datasets for the advanced and DTRA linguists, it appears that the proficiency level that must be attained by a linguist to retain L2 proficiency as long as possible is a high 2+ or 3, for listening

and reading. Listening and reading proficiencies, both receptive skills, reinforce each other, but what was not expected was the possible positive effect speaking might have on L2 retention.

The difference between the DTRA and advanced cohorts was the speaking proficiency level. The DTRA linguists' speaking proficiency was a half step higher than the advanced cohort's proficiency. Further study on this relationship is warranted, but results from these two cohorts demonstrate that the minimum speaking proficiency for long-term retention must be at least level 2, with higher scores possibly indicating longer retention.

F. DA SUMMARY

1. Questionnaires

The DA contains many tools to help a returning linguist achieve the goals of the course. Unfortunately, many of the student profiles did not contain the results from the E&L, MBTI, Barsch, and MSLQ questionnaires. There were only 75 profiles that contained results from the E&L, MBTI, and Barsch questionnaires, and only 28 profiles contained the MSLQ questionnaire results. There were not enough observations to conduct an analysis to see if the results from these questionnaires are associated with a linguist's success at retaining and reacquiring L2 skills.

2. Learning Plans

Individualized learning plans are the end result of the DA, and hypothesis four stated that these plans were vital in identifying the linguist's declarative knowledge or skills that strong enough to transition to procedural. The student profiles only contained 33 learning plans, and these plans varied significantly in quality. Some were well thought out and were designed to help the linguists achieve the course goals as well as exceed their baseline proficiency skill, while others contained little information. These plans were to identify student's strengths and weaknesses, as well as present a plan to assist the students in overcoming their weaknesses. Many of these plans contained the same strategies and advice for specific weaknesses; a sample of frequently repeated strategies is found in Table 21.

Table 21. Common Strategies Found in Student Learning Plans

Skill	Advice or Strategy
Listening	Study high-level vocabulary to build lexicon
	Listen to a recorded passage and write down unfamiliar words. Listen to the passage again and write definitions or descriptions for those words based on information provided in the context. Then, compare your guesses with a dictionary
Reading	Read more about target culture and people to increase your socio-cultural awareness. Read out loud.
	Work on sophisticated informal materials as well as “reading between the lines” to perfect comprehension of reading materials
	Develop vocabulary & word formation; learn synonyms and antonyms and commonly-used word combinations
Speaking	Increase your vocabulary, correct unnatural expressions and memorize them, and have regular speaking practice to increase fluency (focus on accuracy)
	Write down unknown words that come up during conversation and use them in future conversations. Increase grammar knowledge

To evaluate the success of these learning plans, we planned to compare the learning plans to the final diagnostic profile written by the teaching team regarding each student’s performance on the listening, reading, and speaking. That was not possible since student profiles that contained a learning plan did not have the end of course summary, or the profile contained the summary but not a learning plan. Some of the final diagnostic profiles contained testimonial proof, listed in Table 22, that the learning plan developed for the student was effective since the student increased his or her proficiency by a certain number of points. We were unable, however, to verify the testimonial proof with the actual learning plan. The listening section in Table 22 contains the only reference we found in the diagnostic profiles that referred back to a specific strategy in the learning plan. While there is testimonial proof that the learning plans were effective and helped the student achieve the course goals, the hypothesis could not be tested and is results are inconclusive.

Table 22. Testimonial Proof from the Teaching Teams on the Success of Learning Plan Strategies

Skill	Comments
Listening	The student demonstrated a one and a half point progress comparing with the results of the initial interview. This is a very good result. He was able to satisfy most of the parameters meeting successful listening comprehension at this level. Was able to understand main ideas as well as corresponding supporting facts and details. Both vocabulary and structural control underwent significant improvement and ensured sufficient comprehension of the material at this level (initial recommendation: Expanding vocabulary and grammar through listening and transcribing: “as you come across new vocabulary you encounter in listening to authentic material, transcribe it and the sentence it appears in.”)
Reading	The increase in the proficiency level of one point in RC (reading comprehension) demonstrates the efficiency, validity and appropriateness of the proposed recommendations
Speaking	In conclusion we would like to point out the improvement from level 1+ to 2+ in achieving the goal to advance to sustainable and consistent speaking of at least one point higher than initial. It means that data interpretation and all recommendations, outlined in the individual intervention-learning plan, worked out well and were precise, accurate and successful.
Found multiple times	It means that data interpretation and all recommendations, outlined in the individual intervention-learning plan, worked out well and were precise, accurate and successful.

3. DA Proficiency Scores Compared to DLPT Scores

We observed during our analyses that the results of the DA tests used to determine the linguist’s proficiency level seems to be much lower than the last DLPT the linguist took before the follow-on course. Figures 30 and 31 show the comparison between the listening and reading DA results to the DLPT prior to the follow-on course and found the DA scores were consistently much lower than the DLPT.

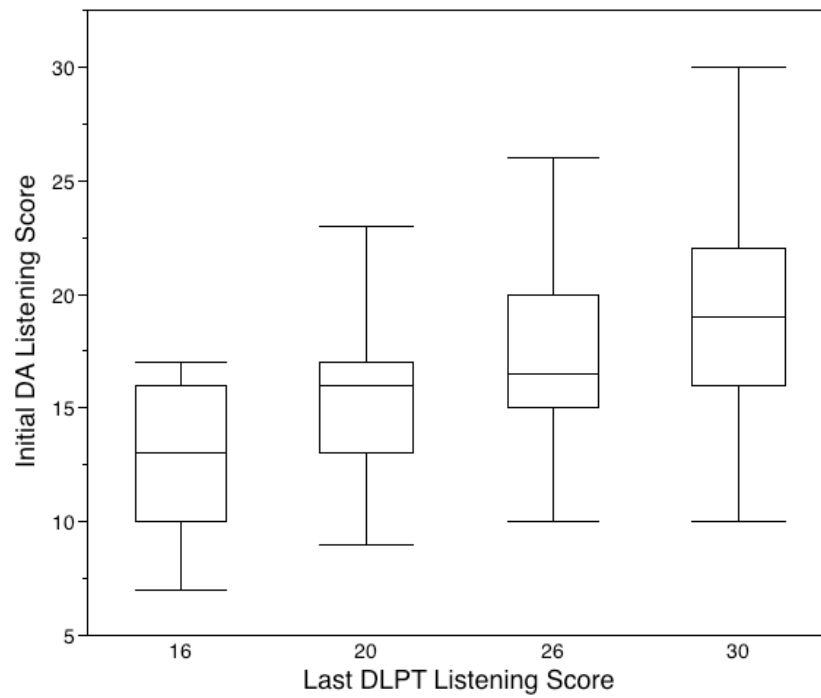


Figure 30. Boxplot of the Initial Listening Diagnostic Assessment by Most Recent DLPT

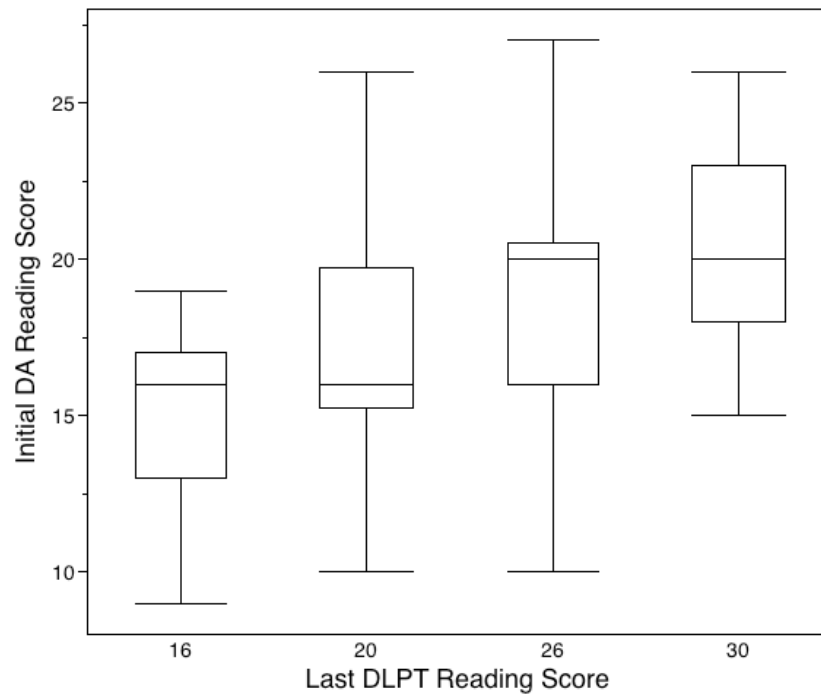


Figure 31. Boxplot of the Initial Reading Diagnostic Assessment by Most Recent DLPT

There are several conjectures why the DA scores were lower than the DLPT: 1) there is an element of measurement instrument learning being manifest. The linguists may remember parts of the DLPT from year to year and when presented with a different style test, their true L2 proficiency is determined and the scores go down. 2) The DLPT is a multiple choice computer proctored exam, whereas the DA is administered by one or two trained evaluators who conduct the DA face-to-face with the linguist. This may cause anxiety in the linguist and lower scores. 3) The DA is a more challenging test than the DLPT. While the initial DA proficiency scores may be lower than the linguist's last DLPT, the final DA appears to be a good indicator of the results the linguist will achieve on the final DLPT.

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V. CONCLUSIONS, RECOMMENDATIONS, AND FUTURE WORK

Modeling and simulations are fruitful ways of explaining language development

—de Bot, 1992

A. CONCLUSION

This dissertation has shown that second language skills are similar to sensory-motor or cognitive skills. The research demonstrates that L2 skills can be modeled by the skill retention theory. This theory suggested several independent variables and possible associations with L2 change. These independent variables were evaluated to determine if any relationships existed. The research suggested that listening, reading, and speaking proficiency attained at the conclusion of DLI, the final basic course GPA, and the length of the incubation period are associated with L2 change. Language and language category hinted at possible associations, but the results were inconclusive.

The skill retention theory and the savings effect suggest that reacquisition of decayed skills will occur at an expedited rate. The majority of the 193 linguists who returned for follow-on training at DLI reacquired their baseline proficiency, and many exceeded it in a shorter period of time than the basic course. These results demonstrate that the skill retention theory can be used to represent L2 skills as well as providing further support for the savings effect.

Additional language training can increase the retention of L2 proficiency if the training is designed to help linguists reacquire and increase their proficiency. While DTRA and advanced course linguists had similar proficiency levels in listening and reading, DTRA linguists' speaking proficiency was a half step higher than the advanced linguists. This difference may have been the reason why DTRA linguists did not have a single terminal event over 13-year period. Speaking may be a significant factor in L2 retention since it requires a linguist to actively produce the L2.

Using the results from the DTRA and advanced linguists, we propose that linguists must attain a proficiency level of a high 2+ to 3 in listening and reading and a

speaking proficiency of 2 to 2+ in order to maintain proficiency as long as possible. A definitive proficiency level is difficult to establish because of individual differences, but when linguists reach this range they are beginning to operate in stage 3 of the skill retention model. Continued training, operations, and experience at this high level will proceduralize more L2 skills and make the linguists' proficiency more immune to decay.

Comments from the DA teaching team lend testimonial proof that the learning plans developed for the returning students correctly identify skills the students need to improve and master in order to operate at the next ILR level. Further work needs to be done to validate that the teaching team uses the individualized learning plan to identify the linguist's declarative skills that are ready to proceduralize in order to move the linguist to the next level.

B. OPERATIONAL RECOMMENDATIONS AND LESSONS LEARNED

The Defense Language Institute is one of the premier language institutions in the world. Annually, thousands of service members are trained to operate as functional linguists at various operational levels in the military. With so many linguists moving through and returning to DLI, there is an opportunity to collect valuable language data for research. Unfortunately, record keeping in some cases has not been standardized and data has been lost or corrupted. The following recommendations are given to help future researchers have access to the most accurate and complete linguist data possible from DLI that can be used to test or validate future DLI policies that meet changing demands.

Macro level:

- Language proficiency loss affects the DoD's ability to carry out its mission to protect the U.S. and its interests. Under Secretary of Defense for Intelligence, Michael Vickers, called for the establishment of a professional military language corps to improve efficiencies in manpower and fiscal resources (Vickers, 2011). As a step towards this goal, we propose that the DoD take a larger role in developing and tracking military linguists to ensure the required skills and languages are available when required.
- We propose that DoD develop a joint service linguist data collection database. This would promote standardized entry of data across services and help track linguists. We recommend the database record the following information:

- Demographic information (service, rank, gender, age) that is not overwritten when a linguist returns to DLI
- DLAB scores
- Languages and proficiency scores
- DLI course information (course, GPA, dates, proficiency scores)
- Annual DLPT and OPI scores, if applicable
- We recommend that DoD develop a schedule for periodic refresher training (in-residence, GLOSS, or other appropriate formats) based on the linguist's original proficiency baseline and current proficiency scores. This standardized schedule would help linguists avoid L2 proficiency decaying to catastrophic failure.
- The DoD should mandate annual oral proficiency interviews for specific linguists, since higher speaking proficiencies appear to prevent skill decay in listening and reading. This can be done using an automated speaking test, which has been proven to provide very accurate results (Bernstein, Van Moere, & Cheng, 2010).

Service level:

- Identify linguist billets that require speaking proficiency to be tested annually.
- Input reasons into DoD linguist database for which the linguist was selected for follow-on training.

DLI level:

- A short survey should be given to each linguist before taking the DLPT to record L2 use and maintenance since the last DLPT. The answers should be saved in DoD's joint service linguist database. We recommend the following questions:
 - How much have you used your second language on the job since the last DLPT in this language (Likert 5-point scale)?
 - What level of language proficiency was required to fulfill your duties?
 - Do you feel you possess the necessary second language skills required for your current duty?
 - Do you use your second language skills outside of the work environment?
 - How have you maintained your second language skills?
- Create a database and a standardized entry procedure for DA data. The DA requires tremendous time to conduct, analyze the data, enter the results, and generate an individualized learning plan. To reduce the data

entry load burden, a standardized form could be created that would have “pick lists” with the most common suggestions for overcoming common mistakes/weaknesses. This could also include the most common metacognitive strategies used by successful linguists in achieving the next proficiency level.

C. FUTURE WORK

Individual differences can make it challenging to analyze data collected from human subjects. Additional challenges in using the DA data were that the data entry was not consistent, data archival was not standardized, and individualized learning plans as well as DA profiles were rarely kept. If DLI accepts our recommendation for a standardized DA database, the research described in this dissertation can be conducted again in 5 to 10 years with a more robust, clean, and complete dataset. The following recommendations are offered for future research:

- Use more languages and language categories to determine if these independent variables are associated with L2 change.
- Compare final DA results with first individualized learning plans. This comparison may help to assess whether the identified skills and proficiencies in the linguist’s learning plan were successful at helping the linguist attain the next ILR level were successful.
- Speaking proficiency demonstrated a potential positive relation with language retention. Future research may further define the relationship between speaking skills and listening and reading. In order to conduct research into this potential relationship, speaking proficiency needs to be tested annually.
- The DA produces a lot of data. Once a standardized format is in place for collecting and preserving these data, further research could explore possible associations between personality profiles, motivation, E&L, learning preferences and L2 change.

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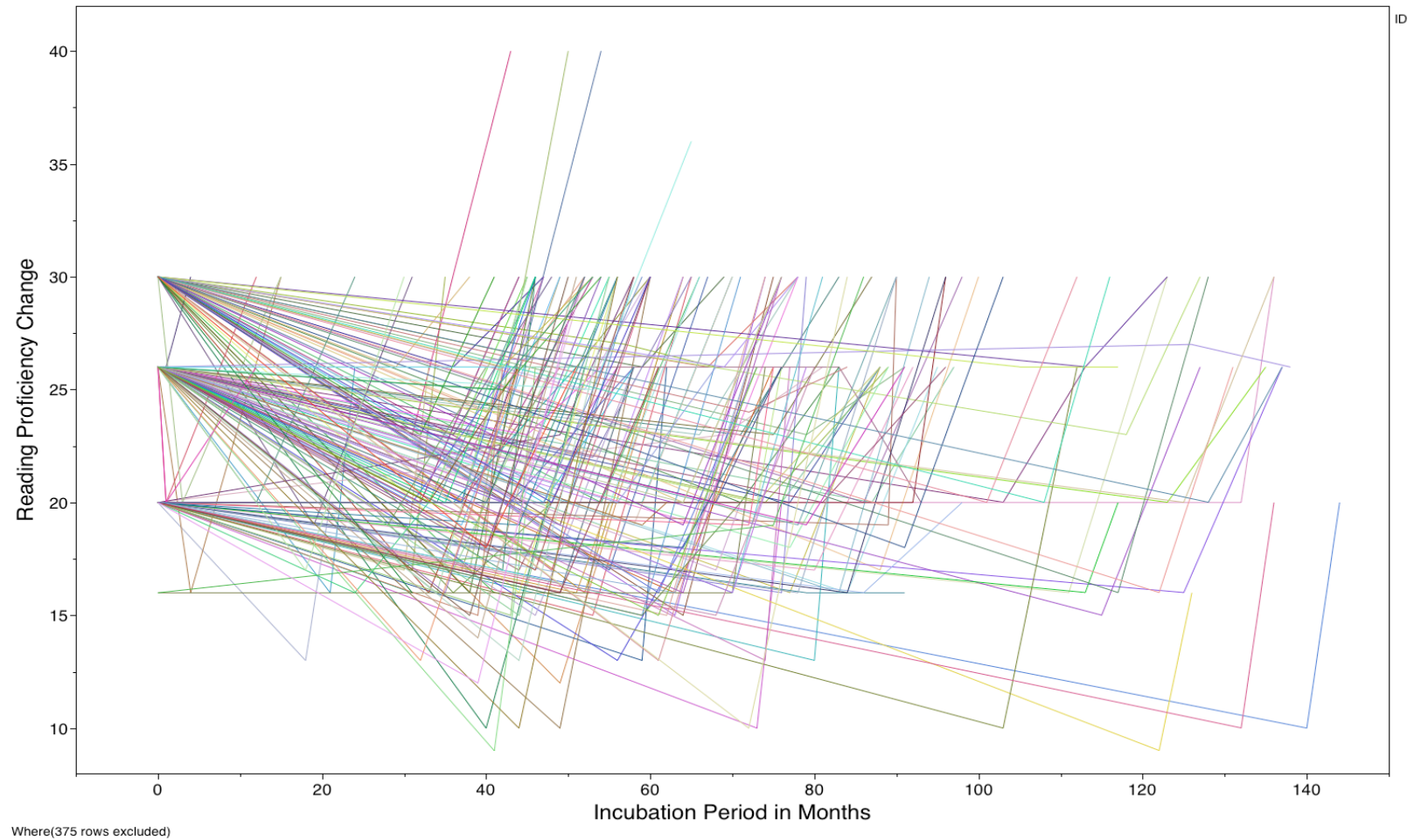
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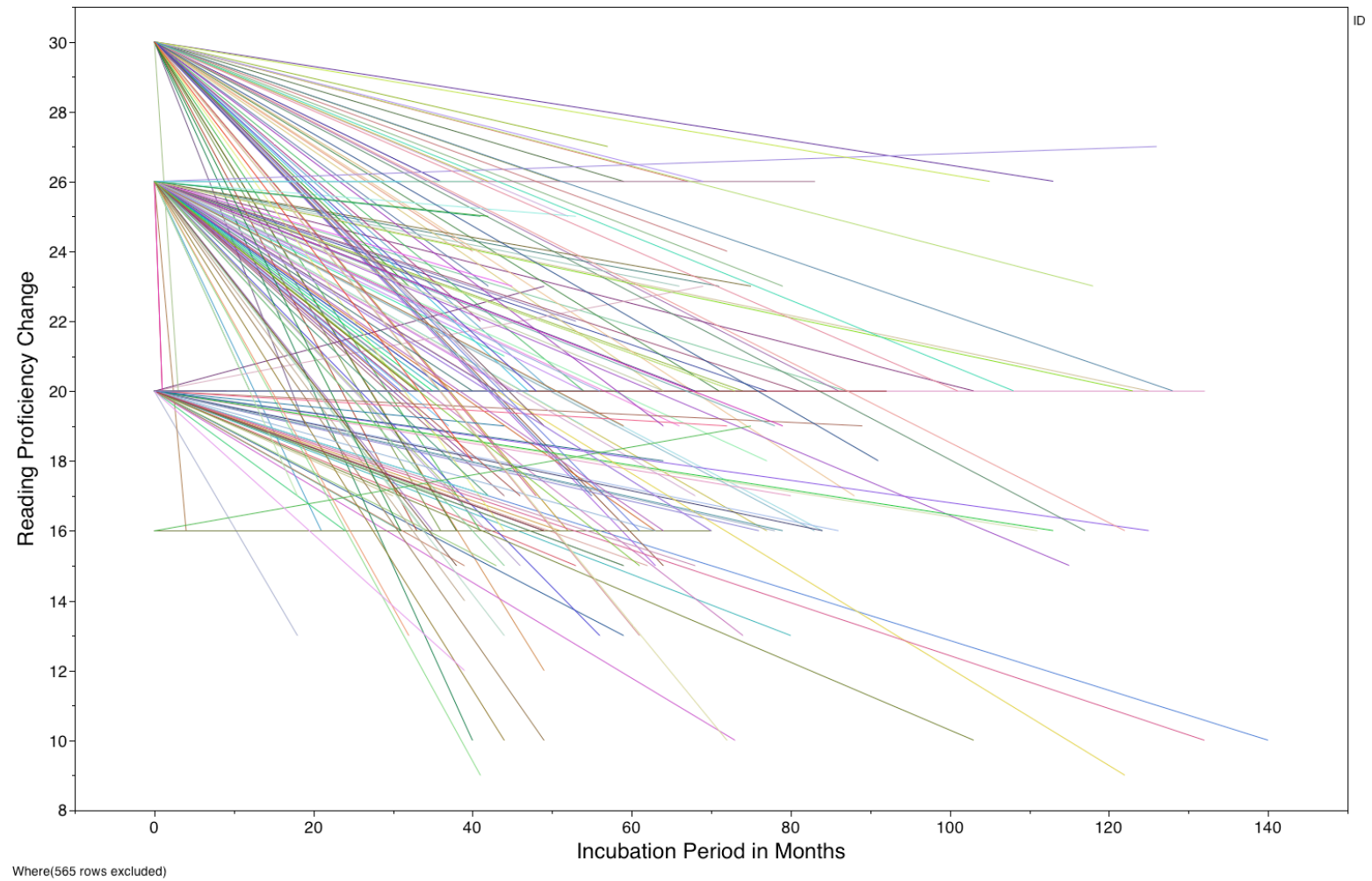
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APPENDIX A: READING PROFICIENCY DECAY DURING INCUBATION AND REACQUISITION DURING FOLLOW-ON COURSE



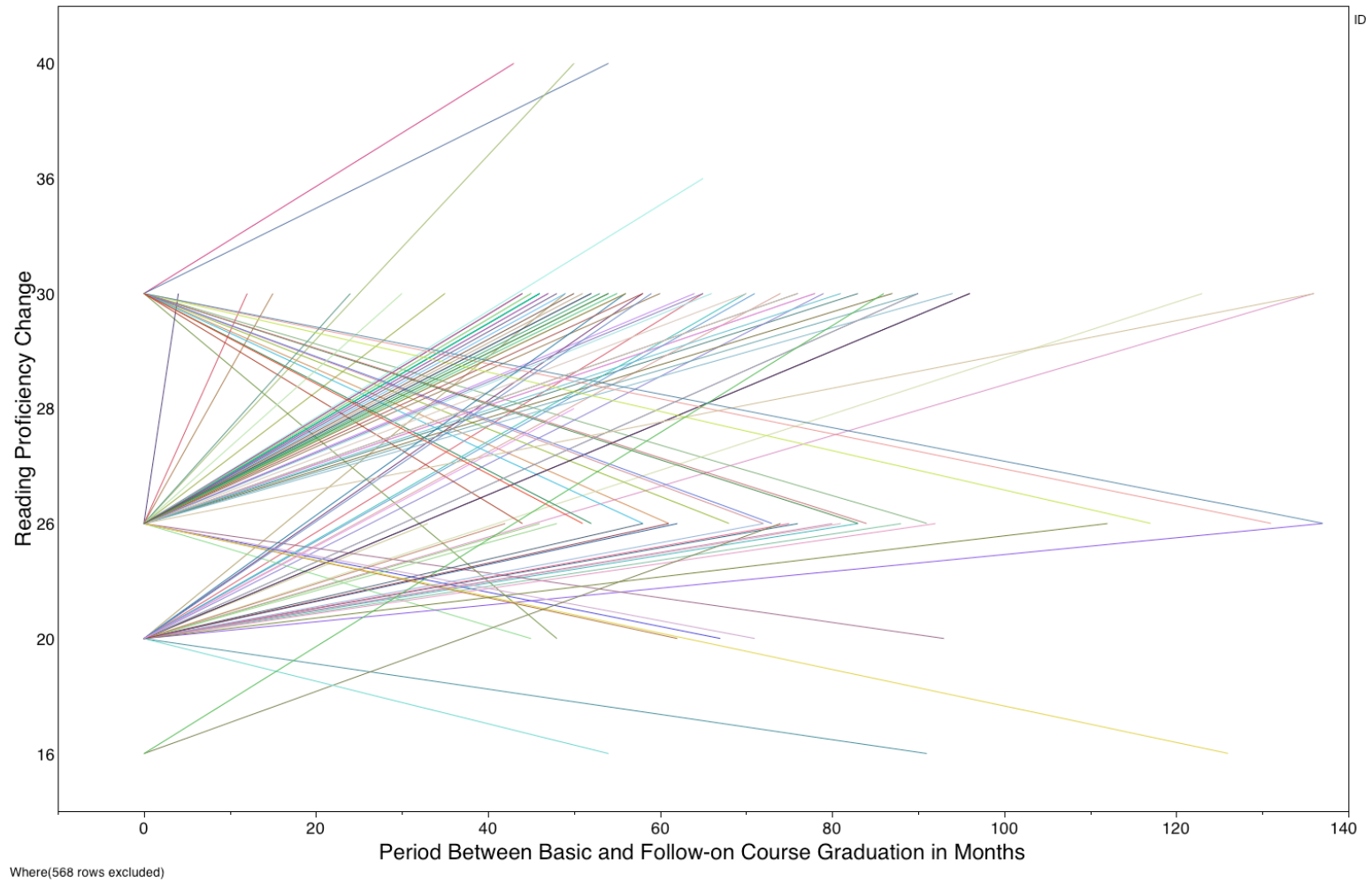
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APPENDIX B: READING PROFICIENCY DECAY DURING INCUBATION PERIOD



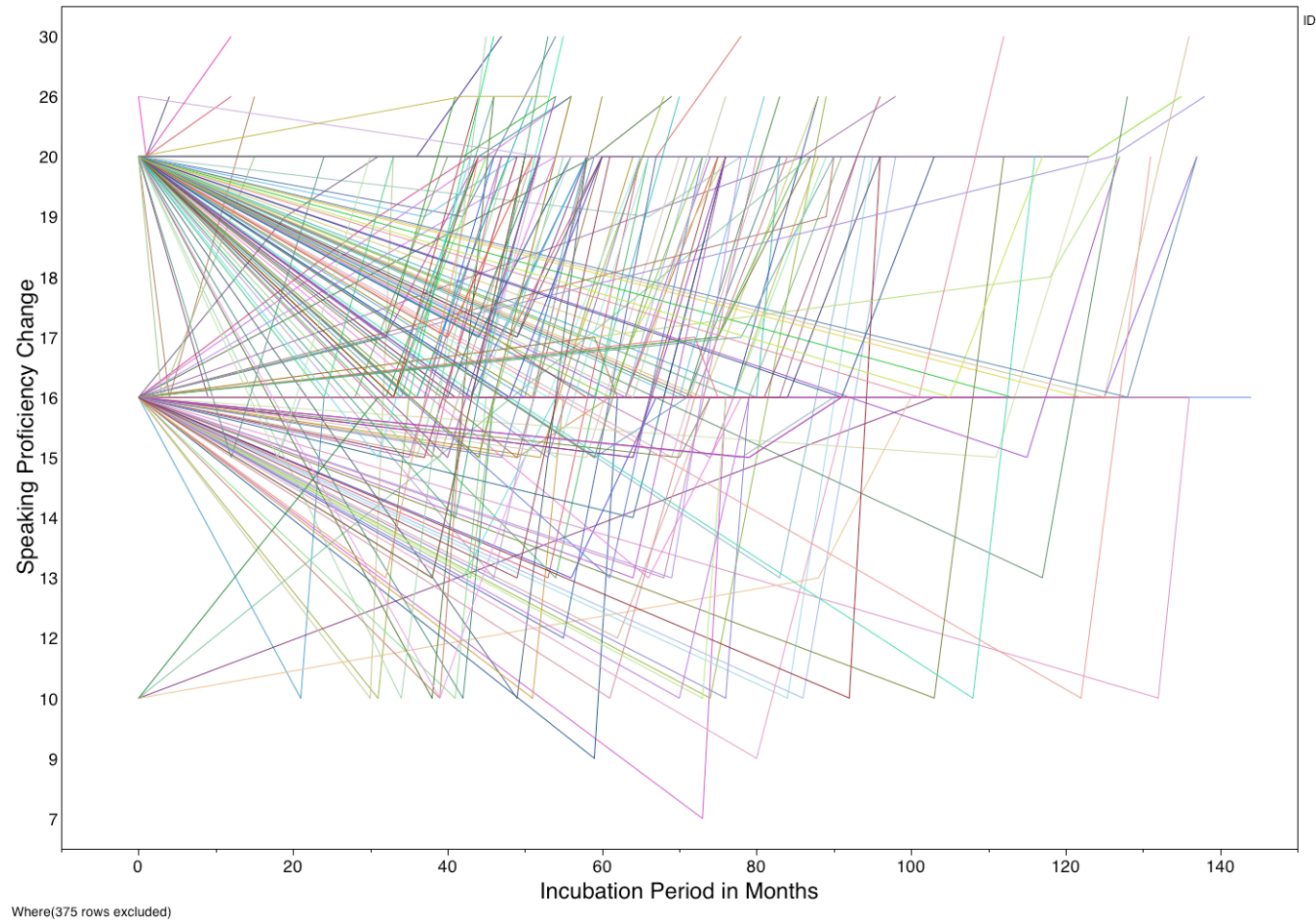
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APPENDIX C: READING PROFICIENCY CHANGE AFTER FOLLOW-ON COURSE



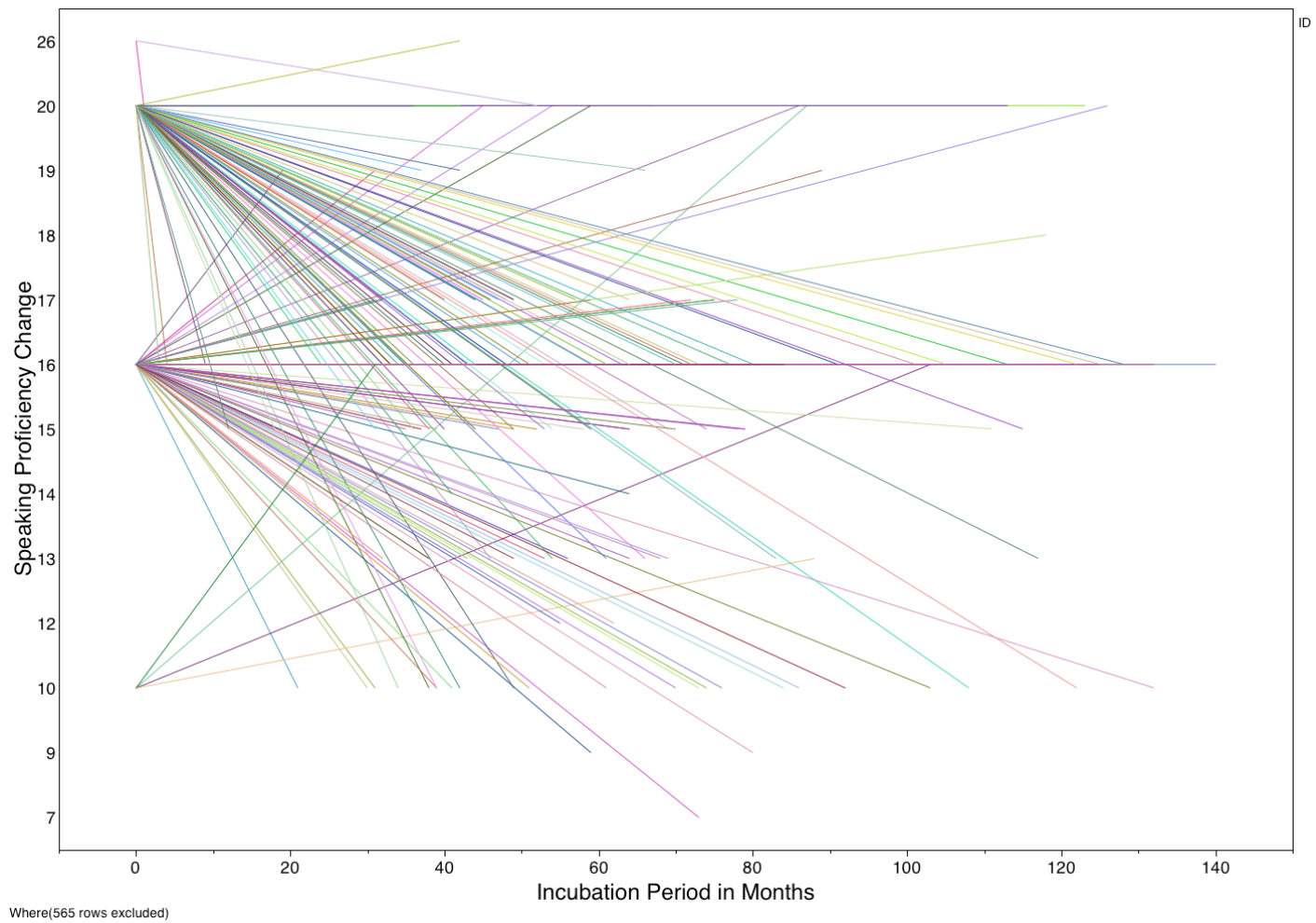
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APPENDIX D: SPEAKING PROFICIENCY DECAY DURING INCUBATION AND REACQUISITION DURING FOLLOW-ON COURSE



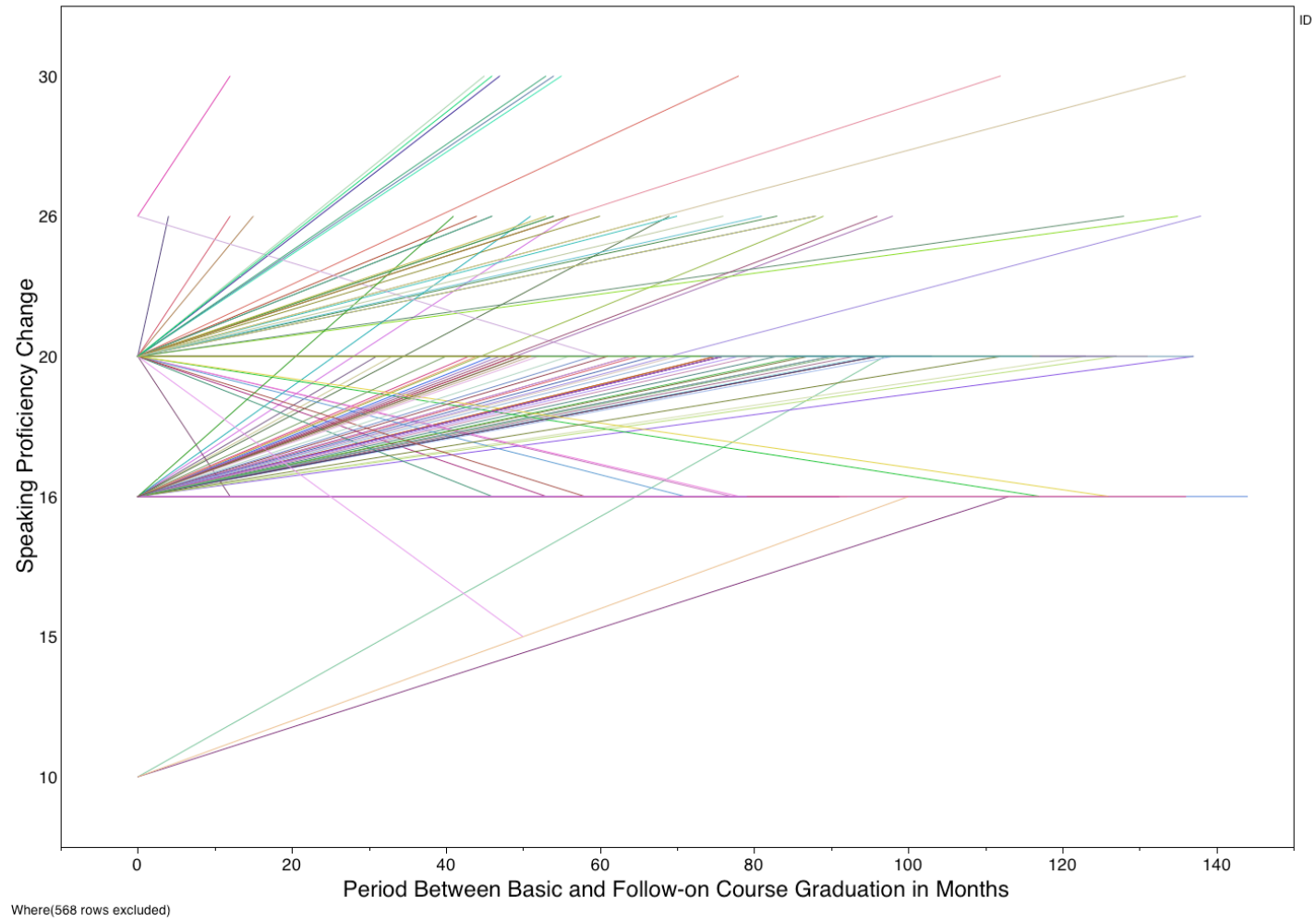
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APPENDIX E: SPEAKING PROFICIENCY DECAY DURING INCUBATION PERIOD



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APPENDIX F: SPEAKING PROFICIENCY CHANGE AFTER FOLLOW-ON COURSE



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APPENDIX G: SAMPLE SUMMARY OF PRE-INTERVIEW DATA

Biographical Data: XX

Education: MA Military Operational Arts and Science; BA in Economics, BA in Urban Planning

Work: DoD, banking

Travels: China, Japan, Taiwan, Canada, Mexico, France, Germany, Italy, Kuwait, Iraq, Afghanistan, Qatar

Interests: Board games, volleyball, computer games, hiking, card games

Others: Heritage speaker of Mandarin Chinese, college courses 3+/3+
Spanish – high school classes/Rosetta stone – minimal

- **E & L Learning Styles Questionnaire:**

Name: XX

Date: Date

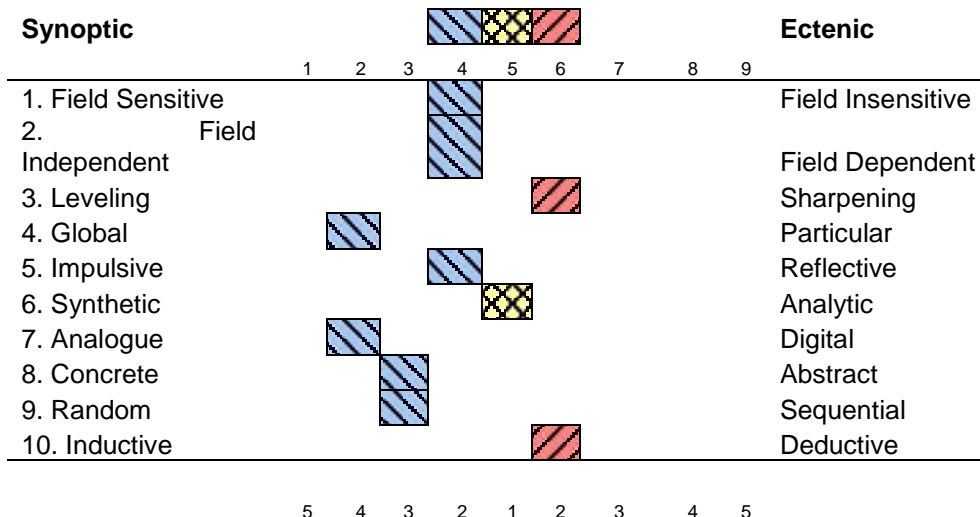
Total: 115

Max

270

0.43

Synoptic



- **Personality Type Questionnaire:** ESTJ

Extrovert	Introvert	Sensing	INTuitive	Thinking	Feeling	Judging	Perceiving
10	0	14	6	18	2	15	5

- **Barsch Learning Style Inventory:**

Visual = 34 ; Auditory = 24 ; Tactile = 20 ; Kinesthetic = 14

- **Motivated Strategies for Learning Questionnaire (MSLQ):**

Scale	Intrinsic Goal Orientation	Extrinsic Goal Orientation	Task Value	Control Beliefs	Self-Efficacy for Learning & Performance	Test Anxiety
Score	6	4	5	5	5	3

- **Writing Sample:**

Global tasks and functions:

Can write a short paragraph on a familiar topic (hometown – Sacramento).

Comprehensibility:

Very good character-writing – only one word was in Pinyin. Very “comprehensible to native readers” (ILR).

Text Type: a “short paragraph” (ILR).

Vocabulary:

“Good control of elementary vocabulary” (ILR) on a city;

“Sufficient vocabulary for a high-frequency concrete subject” (ILR);

“Normally controls general vocabulary with some misuse of everyday vocabulary” (ILR);

“Control of general vocabulary is adequate to convey message accurately” (ILR);

Structural Control:

“Strong in vocabulary” (ILR), but lack of “compound and complex sentences” (ILR). In addition, grammatical structures shows the influence of English.

Socio-Cultural Competence: “Style is obviously foreign” (ILR).

Spelling/Punctuation:

“Punctuation is generally controlled”; (ILR)

“Spelling is adequate to convey message”; (ILR)

“Errors virtually never interfere with comprehension” (ILR)

Excellent character writing – neat, accurate, and near-native.

APPENDIX H: E&L LEARNING STYLE QUESTIONNAIRE V.2.0

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Name: _____

INSTRUCTIONS:

Date: _____

Mark in the space for each pair of items what you think you are like. For example, if you like bicycling much more than swimming, you might mark in space 2 (or even 1), like this:

I like riding a bicycle.

I like swimming.

0. Most like this 1 x 3 4 5 6 7 8 9 Most like this

If you sort of like swimming better, you might mark in space 6.

I like riding a bicycle.

I like swimming.

0. Most like this 1 2 3 4 5 x 7 8 9 Most like this

If you think you are in the middle or really do both equally, use space 5.
Try to avoid using space 5 if you can.

I like riding a bicycle.

I like swimming.

0. Most like this 1 2 3 4 x 6 7 8 9 Most like this

There are no right or wrong answers on this questionnaire.

Here are the questions:

1. When I work with new language in context, in stories or articles or at sentences; I often pick up new words, ideas, etc., that way, without planning in advance.

I don't usually get much from the context unless I pay close attention to what I'm doing. (1a)

1. Most like this 1 2 3 4 5 6 7 8 9 Most like this

2. When working with new material with additional subject matter around it, I comfortably find and use what is most important.

When there is a lot of information that comes with what I need to learn, it's hard to tell what's most important. It all seems to fall together sometimes, and it's hard work to sort things out. (2a)

2. Most like this 1 2 3 4 5 6 7 8 9 Most like this

3. I like to reduce differences and look for similarities.

I like to explore differences and disparities among things. (3a)

3. Most like this 1 2 3 4 5 6 7 8 9 Most like this

4. I tend to be most aware of the 'big picture;'

I notice specifics and details quickly. (4a)

4. Most like this

1	2	3	4	5	6	7	8	9
---	---	---	---	---	---	---	---	---

Most like this

5. I react quickly.

I take my time to react. (5a)

5. Most like this

1	2	3	4	5	6	7	8	9
---	---	---	---	---	---	---	---	---

Most like this

6. I understand best by assembling what I'm learning into a whole.

I understand best by disassembly of what I'm learning into its component parts. (6a)

6. Most like this

1	2	3	4	5	6	7	8	9
---	---	---	---	---	---	---	---	---

Most like this

7. I tend to learn things through metaphors.

I like it when people say what they mean directly. (7a)

7. Most like this

1	2	3	4	5	6	7	8	9
---	---	---	---	---	---	---	---	---

Most like this

8. To learn, I like to interact with the world.

I like to learn through concepts and ideas. (8a)

8. Most like this

1	2	3	4	5	6	7	8	9
---	---	---	---	---	---	---	---	---

Most like this

9. I learn best when I can work out for myself the best sequence to use, even if it's different from the one in the book or lesson.

I learn best when there is a sequence of steps provided, so I can do things in order. (9a)

9. Most like this

1	2	3	4	5	6	7	8	9
---	---	---	---	---	---	---	---	---

Most like this

10. When I learn, I mostly start with examples or my experience and make generalizations or rules.

When I learn, I mostly start with rules and generalizations and apply them to my experience to learn. (10a)

Most like this

1	2	3	4	5	6	7	8	9
---	---	---	---	---	---	---	---	---

Most like this

11. I often find that I have picked up new words, phrases, and so on without realizing it.

I usually have to undertake focused study before I learn new words or phrases. I wouldn't describe myself as someone who learns by 'osmosis.' (1b)

11. Most like this

1	2	3	4	5	6	7	8	9
---	---	---	---	---	---	---	---	---

Most like this

12. I like out-of-context material like grammar rules.

Grammar rules and pieces of language that are out of context are hard for me to work with. (2b)

12. Most like this

1	2	3	4	5	6	7	8	9
---	---	---	---	---	---	---	---	---

Most like this

13. I notice mostly how things are similar.

I quickly notice differences, even fairly fine distinctions. (3b)

Most like this ₁ ₂ ₃ ₄ ₅ ₆ ₇ ₈ ₉ Most like this

14. I notice the 'forest' before the 'trees.'

I tend to be aware of the 'trees' before the
'forest.' (4b)

14. Most like this Most like this
 1 2 3 4 5 6 7 8 9

15. I don't have to spend much time preparing for something; instead, I start off working immediately.

Before starting anything, I want
time to orient myself to it. (5b)

15. Most like this Most like this
 1 2 3 4 5 6 7 8 9

16. I often make up new words or sentences using language I already know.

I seek to understand the system that
is behind words and sentences by
pulling them apart in my mind. (6b)

16. Most like this Most like this

 1 2 3 4 5 6 7 8 9

17. I prefer to learn by using lots of associations.

I prefer to use rehearsal and repetition. (7b)

17. Most like this Most like this

 1 2 3 4 5 6 7 8 9

18. I like to learn through applying knowledge and theory.

I like to learn through descriptions and grammars that formally represent knowledge. (8b)

18. Most like this Most like this
 1 2 3 4 5 6 7 8 9

19. Too much emphasis on a curriculum or textbook can get in the way of my learning.

Organized textbooks and lesson plans
really help me. (9b)

19. Most like this Most like this
 1 2 3 4 5 6 7 8 9

20. I like to figure out grammar rules for myself.

I prefer to get the grammar rules from
the teacher or a book. (10b)

20. Most like this Most like this
 1 2 3 4 5 6 7 8 9

21. I learn best from language that is in meaningful context like stories and conversations.

I don't like to have to learn from just conversations, informal language use, or readings for native speakers that I haven't been prepared for. (1c)

21. Most like this _____ Most like this _____

- | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
|--|---|---|---|---|---|---|---|---|---|---|
| 22. When faced with new language, I reconceptualize it so that it makes sense in my own terms. | | | | | | | | | | I accept what is presented to me and take it pretty much as presented. (2c) |
| 22. Most like this | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Most like this |
| 23. I tend not to remember small distinctions, such as those between similar-seeming words or symbols. | | | | | | | | | | I have a good memory for fine distinctions such as those between similar-seeming words or symbols. (3c) |
| 23. Most like this | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Most like this |
| 24. I start with the main points and work down to the details. | | | | | | | | | | I begin with the details to work up to the main points. (4c) |
| 24. Most like this | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Most like this |
| 25. I often act or speak without thinking about it. | | | | | | | | | | I tend to think about things before I do or say them. (5c) |
| 25. Most like this | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Most like this |
| 26. I sometimes make up new ways to say sentences things. | | | | | | | | | | I prefer figuring out how words and are put together. (6c) |
| 26. Most like this | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Most like this |
| 27. It helps to understand the meanings behind the actual words. | | | | | | | | | | It's usually okay to take what I'm learning at face value. (7c) |
| 27. Most like this | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Most like this |
| 28. I like learning when I can touch, see, or hear. | | | | | | | | | | I prefer to learn abstractly through theories. (8c) |
| 28. Most like this | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Most like this |
| 29. It doesn't matter if the material I'm learning isn't very organized; I can find a way to use it. | | | | | | | | | | It's important to go step-by-step as I learn. (9c) |
| 29. Most like this | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Most like this |
| 30. When learning, I make guesses and then seek evidence to confirm or modify my ideas. | | | | | | | | | | When learning, I would rather learn what I need to know directly, without fumbling around. (10c) |
| 30. Most like this | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Most like this |

APPENDIX I: PERSONALITY TYPE QUESTIONNAIRE

Name_____ Date_____

Personality Types

Directions: Decide on answer (a) or (b) and put a check mark in the proper column of the answer sheet on page 6. Scoring directions are provided. There are no right or wrong answers since about half the population agrees with whatever answer you choose.

1 When the phone rings do you

___(a) hurry to get it first

___(b) hope someone else will answer

2 Are you more

___(a) observant than introspective

___(b) introspective than observant

3 Is it worse to

___(a) have your head in the clouds

___(b) be in a rut

4 With people are you usually more

___(a) firm than gentle

___(b) gentle than firm

5 Are you more comfortable in making

___(a) critical judgments

___(b) value judgments

6 Is clutter in the workplace something you

___(a) take time to straighten up

___(b) tolerate pretty well

7 Is it your way to

___(a) make up your mind quickly

___(b) pick and choose at some length

8 Waiting in line, do you often

___(a) chat with others

___(b) stick to business

9 Are you more

___(a) sensible than ideational

___(b) ideational than sensible

10 Are you more interested in

___(a) what is actual

___(b) what is possible

11 In making up your mind, are you more likely to go by

___(a) data

___(b) desires

12 In sizing up others do you tend to be

___(a) objective and impersonal

___(b) friendly and personal

13 Do you prefer contracts to be

___(a) signed, sealed, and delivered

___(b) settled on a handshake

14 Are you more satisfied having

___(a) a finished product

___(b) work in progress

15 At a party, do you

___(a) interact with many, even strangers

___(b) interact with a few friends

16 Do you tend to be more

___(a) factual than speculative

___(b) speculative than factual

17 Do you like writers who

___(a) say what they mean

___(b) use metaphors and symbolism

18 Which appeals to you more:

___(a) consistency of thought

___(b) harmonious relationships

19 If you must disappoint someone, are you usually

___(a) frank and straightforward

___(b) warm and considerate

20 On the job, do you want your activities

___(a) scheduled

___(b) unscheduled

21 Do you more often prefer

___(a) a final, unalterable statements

___(b) tentative, preliminary statements

22 Does interacting with strangers

___(a) energize you

___(b) tax your reserves

23 Facts

___(a) speak for themselves

___(b) illustrate principles

24 Do you find visionaries and theorists

___(a) somewhat annoying

___(b) rather fascinating

25 In a heated discussion, do you

___(a) stick to your guns

___(b) look for common ground

26 Is it better to be

___(a) just

___(b) merciful

27 At work, is it more natural for you to

___(a) point out mistakes

___(b) try to please others

28 Are you more comfortable

___(a) after a decision

___(b) before a decision

29 Do you tend to

___(a) say right out what's on your mind

___(b) keep your ears open

30 Common sense is

___(a) usually reliable

___(b) frequently questionable

31 Children often do not

___(a) make themselves useful enough

___(b) exercise their fantasy enough

32 When in charge of others do you tend to be

___(a) firm and unbending

___(b) forgiving and lenient

33 Are you more often

___(a) a cool-headed person

___(b) a warm-hearted person

34 Are you prone to

___(a) nailing things down

___(b) exploring the possibilities

35 In most situations are you more

___(a) deliberate than spontaneous

___(b) spontaneous than deliberate

36 Do you think of yourself as

___(a) an outgoing person

___(b) a private person

37 Are you more frequently

___(a) a practical sort of person

___(b) a fanciful sort of person

38 Do you speak more in

___(a) particulars than generalities

___(b) generalities than particulars

39 Which is more of a compliment:

___(a) "There's a logical person"

___(b) "There's a sentimental person"

40 Which rules you more

___(a) your thoughts

___(b) your feelings

41 When finishing a job, do you like to

___(a) tie up all loose ends

___(b) move on to something else

42 Do you prefer to work

___(a) to deadlines

___(b) just whenever

43 Are you the kind of person who

___(a) is rather talkative

___(b) doesn't miss much

44 Are you inclined to take what is said

___(a) more literally

___(b) more figuratively

45 Do you more often see

___(a) what's right in front of you

___(b) what can only be imagined

46 Is it worse to be

___(a) a softy

___(b) hard-nosed

47 In trying circumstances are you sometimes

___(a) too unsympathetic

___(b) too sympathetic

48 Do you tend to choose

___(a) rather carefully

___(b) somewhat impulsively

49 Are you inclined to be more

___(a) hurried than leisurely

___(b) leisurely than hurried

50 At work do you tend to

___(a) be sociable with your colleagues

___(b) keep more to yourself

51 Are you more likely to trust

___(a) your experiences

___(b) your conceptions

52 Are you more inclined to feel

___(a) down to earth

___(b) somewhat removed

53 Do you think of yourself as a

___(a) tough-minded person

___(b) tender-hearted person

54 Do you value in yourself more that you are

___(a) reasonable

___(b) devoted

55 Do you usually want things

___(a) settled and decided

___(b) just penciled in

56 Would you say you are more

___(a) serious and determined

___(b) easy-going

57 Do you consider yourself

___(a) a good conversationalist

___(b) a good listener

58 Do you prize in yourself

___(a) a strong hold on reality

___(b) a vivid imagination

59 Are you more drawn to

___(a) fundamentals

___(b) overtones

60 Which seems the greater fault:

___(a) to be too compassionate

___(b) to be too dispassionate

61 Are you swayed more by

___(a) convincing evidence

___(b) a touching appeal

62 Do you feel better about

___(a) coming to closure

___(b) keeping your options open

63 is it preferable mostly to

___(a) make sure things are arranged

___(b) just let things happen naturally

64 Are you inclined to be

___(a) easy to approach

___(b) somewhat reserved

65 In stories do you prefer

___(a) action and adventure

___(b) fantasy and heroism

66 Is it easier for you to

___(a) put others to good use

___(b) identify with others

67 Which do you wish more for yourself:

___(a) strength of will

___(b) strength of emotion

68 Do you see yourself as basically

___(a) thick-skinned

___(b) thin-skinned

69 Do you tend to notice

___(a) disorderliness

___(b) opportunities for change

70 Are you more

___(a) routinized than whimsical

___(b) whimsical than routinized

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APPENDIX J: BARSCH LEARNING STYLE INVENTORY

Barsch Learning Style Inventory				
No	Statements	Often	Sometimes	Seldom
1	I remember more about a subject through listening than reading.	5	3	1
2	I follow written directions better than oral directions.	5	3	1
3	Once shown a new physical movement, I perform it quickly with few errors.	5	3	1
4	I push down extremely hard with a pen or pencil when writing.	5	3	1
5	I require explanations of diagrams, graphs, or visual directions.	5	3	1
6	I enjoy working with tools.	5	3	1
7	I am skillful with and enjoy developing and making graphs and charts.	5	3	1
8	I can tell if sounds match when presented with pairs of sounds.	5	3	1
9	I can watch someone do a dance step and easily copy it myself.	5	3	1
10	I can understand and follow directions on maps.	5	3	1
11	I do better at academic subjects by listening to lectures and tapes.	5	3	1
12	I frequently play with coins or keys in my pocket.	5	3	1
13	I enjoy perfecting a movement in a sport or in dancing.	5	3	1
14	I can better understand a news article by reading about it in the paper than by listening to the radio.	5	3	1
15	I chew gum, smoke, or snack during studies.	5	3	1
16	I feel the best way to remember is to picture it in my head.	5	3	1
17	I enjoy activities that make me aware of my body's movement.	5	3	1
18	I would rather listen to a good lecture or speech than read the same material in a textbook.	5	3	1
19	I consider myself an athletic person.	5	3	1
20	I grip objects in my hands during learning.	5	3	1
21	I would prefer listening to the news on the radio rather than reading about it in the newspaper.	5	3	1
22	I like to obtain information on an interesting subject by reading relevant materials.	5	3	1
23	I am highly aware of sensations and feelings in my hips and shoulders after learning a new movement or exercise.	5	3	1
24	I follow oral directions better than written ones.	5	3	1
25	It would be easy for me to memorize something if I could just use body movements at the same time.	5	3	1
26	I like to write things down or take notes for visual review.	5	3	1
27	I remember best when writing things down several times.	5	3	1
28	I learn to spell better by repeating the letters out loud than by writing the word on paper.	5	3	1
29	I frequently have the ability to visualize body movements to perform a task. e.g., corrections of batting stance, dance positions, etc.	5	3	1
30	I could learn spelling well by tracing over the letters.	5	3	1
31	I feel comfortable touching, hugging, shaking hands, etc.	5	3	1
32	I am good at working and solving jigsaw puzzles and mazes.	5	3	1

Scoring Procedure

Place the point value on the line next to its corresponding line number. Next, add the points to obtain the preference scores under each heading.

Visual		Auditory		Tactile		Kinesthetic	
Number	Points	Number	Points	Number	Points	Number	Points
2		1		4		3	
7		5		6		9	
10		8		12		13	
14		11		15		17	
16		18		20		19	
22		21		27		23	
26		24		30		25	
32		28		31		29	
Total		Total		Total		Total	

Primary Visual Learners

Those with high visual scores tend to get the impact of material by seeing the information. This begins the processing, organizing and storage for later retrieval. The following is a list of suggestions for visual learners:

1. Take good notes in lectures; reorganize them into small cards that can be carried with you and reviewed in spare moments.
2. Read an assignment for 25 minutes (no more, you lose 85% of your input after the first 25 minutes). When beginning a textbook assignment, first read the summary at the end to get a general idea of the information. Then begin reading.
3. Underline main points in an eye-catching color.
4. At the end of 25 minutes, take a 1-5 minute break. Disconnect totally from your reading – exercise, relax, snack, do that which is comfortable for you.
5. Review your underlined material.
6. Repeat steps 1-5 until reading is completed.

Primary Auditory Learners

Those with high auditory scores tend to prefer material to which they can listen. The following suggestions are designed for primary auditory learners:

1. Tape your lectures and take your notes from tape. This gives you a double auditory input. Some students find that taking notes from the lecture interferes with accurately catching all the verbal material. Put notes on cards that you can carry. Review the notes out loud.
2. Read an assignment for 25 minutes (no more, you lose 85% of your input after the first 25 minutes). When beginning a textbook assignment, first read the summary at the end to get a general idea of the information. Then begin reading.
3. Underline main points in an eye-catching color.
4. At the end of 25 minutes, take a 1-5 minute break. Disconnect totally from your reading – exercise, relax, snack, do that which is comfortable for you.
5. Read aloud all underlined material. If you take notes instead of underlining in the book, read your notes aloud.
6. Try to form a study group with classmates. Talk with them about the central ideas you discovered in your assignment.

Primary Tactile Learners

Primary tactile learners would benefit from finding their secondary learning mode and using the directions for either visual or auditory in conjunction with the following:

1. Auditory or Visual #1-4
2. Review your underlined material (aloud if auditory is secondary)
3. Using your finger, trace the words you are learning in the air in front of you. Look at the words while you are tracing them.
4. Keep something in your hands that is malleable. Knead or tap a rhythm (4/4 background music) as you study. As much as possible, translate what you're learning into something that can be touched. Typing is helpful. If possible, type your notes onto cards.

Primary Kinesthetic Learners

Primary kinesthetic learners would benefit from finding their secondary learning mode and using the directions for either visual or auditory in conjunction with the following:

1. Whenever possible, use manipulatives that create whole concepts, including appropriate games.
2. Put your favorite music on the stereo, then try to move on the beat and repeat the information you are studying while you are moving with the music.
3. Seek group interactions.

4. Rely on the arts (dancing, singing, poetry, crafts, etc).
5. Ask for assignments involving experiments and/or constructing things.
6. Look for opportunities to perform with dialogue and reality-based sets and costumes.
7. Study and review notes and materials while walking or jogging.

If all of your scores are fairly close, use the methods outlined for all 4 types of learning styles. All learners will increase their efficiency by learning some simple steps:

1. Learn a Relaxation Technique. Sit in a comfortable chair and consciously “let go” of your muscles and tensions. Begin to breathe in and out to the count of four slowly (find your own best rhythm). Concentrate only on your breathing process. Do this for five minutes or until you are relaxed. (Inhale four counts, hold four counts, exhale four counts.)
2. Quiet Background Music. Much of our learning has a rhythm that is indigenous to each one of us. Background music with a 4/4 beat enhances and helps maintain the relaxed state achieved in your relaxation technique.
3. Use your Olfactory Sense. One of your most primary learning modes is your sense of smell. Studying in an environment that has a pleasant odor (i.e., perfume, peppermint candy, etc.) that can be repeated during exams stimulates the recall process.
4. Use Natural Timing. When studying lists and facts, read them and say them, counting to eight between each input. This allows time for processing and integrating one fact before the input of the second.

APPENDIX K: MOTIVATED STRATEGIES FOR LEARNING QUESTIONNAIRE

Motivation

The following questions ask about your motivation for and attitudes about this class. **Remember there are no right or wrong answers, just answer as accurately as possible.** Use the scale below to answer the questions. If you think the statement is very true of you, circle 7; if a statement is not at all true of you, circle 1. If the statement is more or less true of you, find the number between 1 and 7 that best describes you.

1	2	3	4	5	6	7
not at all						very true
true of me						of me

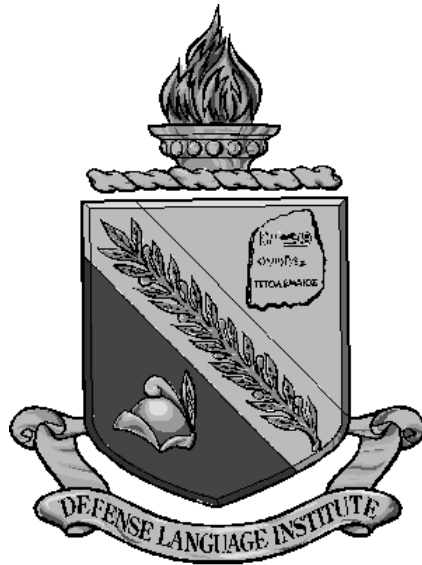
- | | | | | | | | |
|--|---|---|---|---|---|---|---|
| 1. In a class like this, I prefer course material that really challenges me so I can learn new things. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2. If I study in appropriate ways, then I will be able to learn the material in this course. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3. When I take a test I think about how poorly I am doing compared with other students. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4. I think I will be able to use what I learn in this course in other courses. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 5. I believe I will receive an excellent grade in this class. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 6. I'm certain I can understand the most difficult material presented in the readings for this course. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 7. Getting a good grade in this class is the most satisfying thing for me right now. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8. When I take a test I think about items on other parts of the test I can't answer. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

	not at all true of me					very true of me	
9. It is my own fault if I don't learn the material in this course.	1	2	3	4	5	6	7
10. It is important for me to learn the course material in this class.	1	2	3	4	5	6	7
11. The most important thing for me right now is improving my overall grade point average, so my main concern in this class is getting a good grade.	1	2	3	4	5	6	7
12. I'm confident I can learn the basic concepts taught in this course.	1	2	3	4	5	6	7
13. If I can, I want to get better grades in this class than most of the other students.	1	2	3	4	5	6	7
14. When I take tests I think of the consequences of failing.	1	2	3	4	5	6	7
15. I'm confident I can understand the most complex material presented by the instructor in this course.	1	2	3	4	5	6	7
16. In a class like this, I prefer course material that arouses my curiosity, even if it is difficult to learn.	1	2	3	4	5	6	7
17. I am very interested in the content area of this course.	1	2	3	4	5	6	7
18. If I try hard enough, then I will understand the course material.	1	2	3	4	5	6	7
19. I have an uneasy, upset feeling when I take an exam.	1	2	3	4	5	6	7

	not at all true of me					very true of me	
20. I'm confident I can do an excellent job on the assignments and tests in this course.	1	2	3	4	5	6	7
21. I expect to do well in this class.	1	2	3	4	5	6	7
22. The most satisfying thing for me in this course is trying to understand the content as thoroughly as possible.	1	2	3	4	5	6	7
23. I think the course material in this class is useful for me to learn.	1	2	3	4	5	6	7
24. When I have the opportunity in this class, I choose course assignments that I can learn from even if they don't guarantee a good grade.	1	2	3	4	5	6	7
25. If I don't understand the course material, it is because I didn't try hard enough.	1	2	3	4	5	6	7
26. I like the subject matter of this course.	1	2	3	4	5	6	7
27. Understanding the subject matter of this course is very important to me.	1	2	3	4	5	6	7
28. I feel my heart beating fast when I take an exam.	1	2	3	4	5	6	7
29. I'm certain I can master the skills being taught in this class.	1	2	3	4	5	6	7
30. I want to do well in this class because it is important to show my ability to my family, friends, employer, or others.	1	2	3	4	5	6	7
31. Considering the difficulty of this course, the teacher, and my skills, I think I will do well in this class.	1	2	3	4	5	6	7

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APPENDIX L: SAMPLE LEARNING PLAN



LEARNING PLAN FOR SELF-DIRECTED STUDY

Name:

Language: Russian

Unit/School:

Prepared by: Russian team

Date

Purpose of the Learning Plan:

This learning plan is prepared for you based on the diagnostic data collected during the diagnostic assessment interviews. We have also considered the pre-interview data provided by you before the DA interview in response to the questionnaires about learning styles, sensory preferences, and individual personality features, and the writing sample you provided.

The goals of the learning strategies and activities recommended in this plan are to help you maintain and improve your proficiency and progress to the next level in Russian. As you work with the suggested learning strategies and activities, you may find strategies that suit you even better and help you advance in learning Russian. Remember that one goal of this process is for you to learn to identify the learning strategies and types of activities that are most effective for you and your learning needs and goals.

It is helpful to set goals and objectives for yourself, to identify the purpose of the language tasks you undertake, to organize, arrange, and plan your learning, and to regularly monitor your learning to discern whether or not you are making progress towards your stated goals.

Your Current Speaking Skills

You have done a great job improving your vocabulary. You speak confidently and can initiate and maintain conversation on familiar topics. Your production showed that you can control the linguistic features needed for narrating events in three different time frames, but you should pay more attention to the correct word usage, verb aspects, and future tense. Your memory is good, but you still have to work on building up skills of speaking without grammar mistakes. You can describe people, places and things; narrate current activities in full paragraphs, state facts, give instructions or directions. Continue working on discussing abstract topics, support opinions, hypotheses, dealing with unfamiliar topics and situations.

In addition to building your factual vocabulary, which still of course has room for more growth, build up abstract vocabulary in order to discuss topics at the higher level. Try to increase your exposure to Russian through reading texts and internet-based programs of social, historical, and philosophical nature.

The ability to provide very specific information is a growth area for you. To strengthen this ability, you need to spend more time focusing on fine details. Try describing things and events down to the tiniest detail. You have to expand your background knowledge of Russian culture as well as societal issues from Russian viewpoint. In other words, you need more breadth and depth in Russian history, culture, and society. One of the biggest areas where you need improvement is vocabulary. You tend to translate from English a

lot instead of using authentic Russian expressions. Your structural control is very limited.

Recommended Activities for Building Speaking Skills:

Practice narrating about your past experiences: Think about important events in your life. Write essays about some of them. Then identify all verbs, check the accuracy of the verb conjugation, and correct it yourself. Rewrite the essay using the correct forms of the verbs. Record yourself and identify the mistakes made. Pay attention to how things are said by the natives. Look at the context, and the situation in which one thing is more appropriate to say than another. Always pay attention to collocations (which verbs go together with which nouns; nouns with adjective, etc.)

1: Build topic specific vocabulary. Talk about these topics with your colleagues and Russian friends.

2: Try to use diversified phrases or expressions within the same context.

3: Use cohesive devices or transitional words and phrases to join sentences together and show relationship between sentences.

4: Listening to your own speech recording and correcting mistakes, then record the correct version.

5: Make notes about some of the major events in your personal life, including your work experience.

6: Use reading and listening for the development of your speaking skills. Russian media contains a lot of interviews with Russian celebrities and experts on a daily basis. Pay attention to how things are said by the natives. Look at the context, and the situation in which one thing is more appropriate to say than another. Always pay attention to collocations (which verbs go together with which nouns; nouns with adjectives, etc.).

Read out loud, it will help your pronunciation.

7: Keep a journal in Russian. This will help you rehearse language, which you can use later in conversation.

8: Build your own active vocabulary of synonyms. You could start with acquiring a dictionary of Russian synonyms, then work with it – learn synonyms, try to find out the fine nuances of meaning and differences between them, as well as their stylistic appropriateness.

9: In order to fine-tune and expand your active vocabulary continue to learn whole expressions, phrases and typical word combinations, look for them in texts, trace the usage of your favorite words, write them down as patterns and always pay attention to the context words are used in.

10: If you study new vocabulary in context, it is more likely to be remembered and more helpful in creating coherent utterances. Don't learn disconnected words; learn phrases, combinations of words, have readymade formulae in mind. You can make a big collection of those based on listening materials of conversational nature. While producing an oral speech on a chosen topic make your utterances several paragraphs long.

11. Discuss Russian societal issues with your colleagues, Russian friends, or chat on-line to learn more about Russia and to practice your Russian. Remember to observe all safety and security precautions when interacting on-line with strangers.

Your Current Reading Comprehension Skills

You did well at applying your knowledge to what you read. You were especially good in understanding texts with scientific information. You were successful at comprehending the detailed factual information and were good in guessing the meaning of the words from the context. Continue to work on higher level of structural and lexical competence: idioms, co-occurrence and collocation (which words go with which).

In order to achieve higher level in Reading Comprehension learn the language discourse structures such as the placement of relevant information, the communicative features that indicate focus, stress on ideas and development of a topic. Continue to learn how to discern deeper levels of meaning, understand the effect of particles, “flavor words”, etc. as references within the text may be obscure. Try to read texts of different field of interest.

Recommended Activities for Building Reading Comprehension:

- 1:** Expand vocabulary and use different techniques for continued increase of vocabulary. The best way to improve your vocabulary is to use a dictionary regularly. You might carry around a pocket dictionary and use it to look up new words. Or, you can keep a list of words to look up at the end of the day. Concentrate on roots, prefixes and endings.
- 2:** Make sure that you always understand the sentence structure. Pay special attention to the sentences with reverse word order and non-personal sentences.
- 3.** Read articles and editorial pieces which express opinions both explicitly or through inference.
- 5:** Guess the intent of the author, read “between the lines”.
- 6:** Identify idioms in the text and try to figure them out in context, identify “implicit comparison” expressions and know their meaning.
- 8:** Try to break complex sentences down into their component parts, split compound sentences into separate clauses. By breaking long, complex sentences into smaller chunks, you can build the meaning from the bottom up.

The stronger your interest, the greater your comprehension.

Reading comprehension requires motivation, mental frameworks for holding ideas, concentration and good study techniques.

Develop a broad background.

Broaden your background knowledge by reading newspapers, magazines and books in Russian. It is very good that you are interested in world events. Continue to read about them on a daily bases using the Internet.

Know the structure of paragraphs.

Good writers construct paragraphs that have a beginning, middle and end. Often, the first sentence will give an overview that helps provide a framework for adding details. Also, look for transitional words, phrases or paragraphs that change the topic.

Anticipate and predict.

Try to anticipate the author and predict future ideas and questions. If you're right, this reinforces your understanding. If you're wrong, you make adjustments quicker.

Highlight, summarize and review.

Just reading a book once is not enough. To develop a deeper understanding, you have to highlight, summarize and review important ideas.

Good readers monitor their attention, concentration and effectiveness. They quickly recognize if they've missed an idea and backup to reread it.

Resources

www.lenta.ru

www.gazeta.ru

www.utro.ru

www.kp.ru

www.ogonek.ru

www.izvestia.ru

www.rian.ru

www.grani.ru

Your Current Listening Comprehension Skills

You did well overall on the listening material. Your performance at the concrete level (comprehension of news releases, narrations, and separation of time frames: past, present, and future) is good, but still in need of improvement. Continue to expand your background knowledge of socio-cultural issues from a Russian viewpoint. Learn what may be left out (ellipsis) and what words add.

You also demonstrated the ability in detecting emotional overtones in conversations as well as following the essentials of conversations between educated native speakers. Your performance on the latter was primarily somewhat stable. However the ability to decipher possible implications connected to the discourse you were listening to needs improvement. Continue to master the necessary skills in areas such as vocabulary, grammar, and cultural references required for higher-level listening tasks.

Recommendations

- 1:** Make a habit of listening to extra Russian material every day. Use sources that allow you to confirm what you heard- when possible.
- 2:** Avoid translation.
- 3:** Chose appropriate material that you enjoy with the right level of difficulty, gradually increasing it.
- 5:** Listen and learn Russian songs.
- 6:** Explore these Internet resources:

www.radiomayak.ru

www.1tv.ru

www.vesti.ru

www.newsru.com

<http://www.ntv.ru/novosti/>

<http://www.voanews.com/russian/video/>

<http://rian.ru/tv/>

<http://www.tv100.ru/news/>

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1. Defense Technical Information Center
Ft. Belvoir, Virginia
2. Dudley Knox Library
Naval Postgraduate School
Monterey, California